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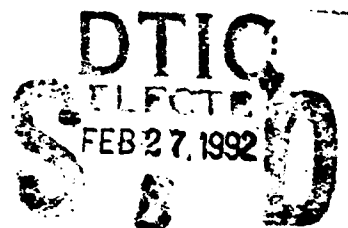
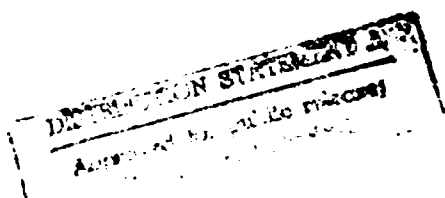


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Sealift in Operation Desert Shield/ Desert Storm: 7 August 1990 to 17 February 1991

Ronald F. Rost
John F. Addams
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1. Enclosure (1) is forwarded as a matter of possible interest.
2. This research memorandum is an update of CNA research memorandum 91-14, which examined the use of sealift in Operation Desert Shield up to 9 January. It extends the analysis to include Desert Storm, describing the responsiveness and contribution to the overall effort of the Afloat Prepositioning Force, fast sealift ships, the Ready Reserve Force, and chartered ships, both foreign and domestic.

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ABSTRACT

This research memorandum examines the use of sealift during Operation Desert Shield/Desert Storm. It describes the responsiveness and contribution to the overall effort of the Afloat Prepositioning Force, fast sealift ships, the Ready Reserve Force, and chartered ships, both foreign and domestic.

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INTRODUCTION AND SUMMARY

This research memorandum examines the use of sealift during Operation Desert Shield/Desert Storm. In an earlier paper [1], CNA examined the performance of the sealift assets that moved equipment and related support during the first 156 days of Desert Shield. This paper updates the earlier analysis to include subsequent sealift operations during Operation Desert Storm. It also includes a brief examination of deliveries of sustainment cargo and fuel which were not covered in [1]. The cutoff date for the information is 18 February 1991.

On 2 August 1990, Iraq invaded Kuwait and, by that action, threatened neighboring Saudi Arabia. In response, on 7 August, the United States began Operation Desert Shield to build up forces, principally in Saudi Arabia and surrounding waters. Phase I of the operation, which ended in November, was designed to deter further Iraqi offensives. During that phase the services moved over four Army divisions, a Marine Expeditionary Force, approximately 1,000 combat aircraft, and 60 Navy ships to the theater—a force of some 240,000 personnel. Phase II began on 7 November and provided the offensive power needed to dislodge Iraqi forces from Kuwait. During this phase, U.S. forces more than doubled.

The United States had not attempted a deployment of this size since the Vietnam War. The size and rate of the buildup necessitated the use of most elements of this country's airlift and sealift force. Table 1 gives a rough comparison of the amount of war material delivered to the theater during Desert Shield/Storm, the Vietnam War, and the Korean War. The Desert Shield/Storm rate was 33 percent higher than that of the Korean War. That performance is particularly impressive considering the distance to the Persian Gulf and the fact that the Navy, the U.S. merchant fleet, and the reserve ship force are much smaller today than they were in 1950.

As table 2 shows, approximately 3.3 million short tons of dry cargo necessary for the deployment and sustainment of the force were delivered to the theater. About 15 percent came by air, but the vast majority, about 2.8 million short tons, was carried by sealift. This report examines the sealift experience during both phases of Desert Shield to document what was achieved and what lessons might be gleaned for future use. It addresses both dry cargo shipments and fuel deliveries.

Table 3 shows the breakdown of sealift cargoes by phase of the operation and by whether the deliveries were initial unit equipment and support, sustaining supplies, or fuel. Although getting exact estimates was difficult since some deliveries were

reported in square feet, some in measurement tons, and others in short tons, an estimated 19 percent of total deliveries of dry cargo represented sustaining supplies. Deliveries of fuel, measured in short tons, outstripped deliveries of dry cargo, largely because fuel did not have to be transported as far. Desert Shield/Storm-related fuel was delivered in large quantities to sites not only in the Persian Gulf, but also in CONUS and Europe. In many cases, fuel was carried from refineries or other storage sites in contiguous locations.

Table 1. Dry cargo delivered by airlift and sealift in
Desert Shield/Storm: a comparison with past experience^{a,b}

	Monthly rate ^c (short tons)	
	First year	Peak year
Operation Desert Shield/Storm	510,000	-
Vietnam War ^d	153,000	523,000
Korean War ^d	385,000	400,000

a. Sources for Desert Shield/Storm data are the Military Sealift Command (MSC) and the Military Airlift Command (MAC). Southeast Asia data are from OSD's Joint Logistics Review Board's 18-volume survey of logistics in the Vietnam War [2]. Korean War data are from CINCPACFLT's periodic Evaluation Reports on U.S. Pacific Fleet operations in the Korean War [8, 4].

b. Airlift data reflect deliveries by MAC or its predecessor, the Military Air Transportation Service (MATS). Sealift reflects MSC deliveries or its predecessor, the Military Sea Transportation Service (MSTS), and includes all Navy-controlled U.S. and foreign charters. In addition, the Desert Shield/Storm data include the contributions of afloat prepositioned forces.

c. Monthly rates are an average of aggregate deliveries over a year or less, depending on the availability of the data. For Desert Shield/Storm the average is based on deliveries through 19 February 1991. For Southeast Asia, the first-year rate is the average over 1965, and the peak-year rate is the monthly average over 1968. For Korea, the first-year rate is from July 1950 through June 1951 for airlift and November 1950 through April 1951 for sealift. The peak-year rate for Korea is from calendar 1952 deliveries by MSTS and MATS.

d. Southeast Asia and Korean War sources used measurement tons for sealift deliveries. For comparative purposes, these were converted to short tons using a factor of 0.5 short ton per average measurement ton.

Table 2. Comparison of sealift and airlift dry cargos (short tons)

	Sealift	Airlift	Total
Phase I	1,170,000	182,500	1,352,500
Phase II	1,675,000	304,000	1,979,000
Total	2,845,000	486,500	3,331,500

Table 3. Sealift deliveries (short tons)

	Unit equipment and support	Sustaining supplies	POL
Phase I	1,034,900	135,100	1,800,000
Phase II	1,270,300	404,700	3,500,000
Total	2,305,200	539,800	5,300,000

SUMMARY

The sealift operation in Desert Shield/Storm was a massive undertaking. All elements of the Navy's sealift assets were involved, in addition to a large number of chartered ships, both domestic and foreign. In Phases I and II, 344 ships were involved in the sealift of unit equipment and related support, and POL:¹

- 25 ships of the Afloat Prepositioning Force, including all 13 maritime prepositioning ships (MPSs) carrying Marine equipment, eight prepositioning (PREPO) ships carrying Army and Air Force cargo, and four tankers in the PREPO force.
- Eight fast sealift ships (FSSs).
- 70 Ready Reserve Force (RRF) ships.

1. This tabulation does not include liner vessels operating under Special Middle East Shipping Agreement (SMESA).

- 191 chartered dry cargo ships: 29 flying the U.S. flag or under effective U.S. control (EUSC), and 162 of foreign flag.
- 50 chartered tankers: 31 flying the U.S. flag or in the EUSC, and 19 flying foreign flags.

The MPSs started arriving at their ports of debarkation only eight days after the start of the operation (C+8). PREPO ships began arriving two days later (C+10). The first FSS began unloading in theater on C+20. As expected, other elements of the sealift arrived later, with the first RRF ship arriving on day C+32, and the first chartered ship (a roll-on/roll-off (RO/RO) ship that was already under long-term charter to the Military Sealift Command (MSC) when Desert Shield began) started unloading on C+33. The first delivery made by a ship chartered after the operation began occurred on C+41.

In addition, numerous U.S.-flag containerships delivered sustaining cargos as part of their regularly scheduled liner service. In order to deliver fuel to the Persian Gulf, Europe, CONUS, and other locations in support of Desert Shield/Storm, the Military Sealift Command (MSC) increased its tanker fleet from 22 in early August 1990 to 48 in early February 1991.

Afloat Prepositioning Force

MPS and PREPO ships responded much as expected. Some MPS ships were not initially at their prepositioning sites, because they were undergoing scheduled maintenance and exercising—a normal occurrence to be expected at the beginning of any no-notice operation. After these ships had made their initial deliveries, they either reverted to common-user status and joined the other sealift assets in moving cargo from the U.S., or were held for intra-theater support.

Fast Sealift Ships

In general, the FSSs performed well also. One broke down in route, and the average speed of advance for those making the first trip was lower than expected—23 knots. For the entire operation, however, the FSSs average 27 knots. The seven operational ships delivered almost 20 percent of the unit equipment and related support in Phase I, and about 12 percent in Phase II. Their high productivity is a reflection of both their size and their speed. Five of the ships completed three deliveries in Phase I; but none did so in Phase II because it had to be accomplished in a shorter period.

Ready Reserve Force

RRF activations did not achieve desired standards. Of the 44 RRF ships receiving activation orders during Phase I, only 12 were actually activated on time. Twelve ships were one to five days late, and 20 were at least six days late. Of the 26 ships called in Phase II, only 3 activated on time, 17 were more than five days late. Mechanical failures were the cause of the vast majority of the delays.

Once activated, the RRF ships performed better, delivering about 30 percent of the unit equipment (and related support) in Phase I, and 25 percent in Phase II.

Chartered Ships

During Desert Shield/Storm, MSC made extensive use of chartered ships to move military cargo. There were four principal reasons:

- RO/ROs were preferred for lifting cargo, and there were only 17 in the RRF.
- There were both actual and anticipated delays in activating RRF ships.
- Doubts about the ability to get sufficient crews for RRF ships had increased by late August.
- The cost of activating RRF ships is high.

Most charters have been foreign-flag ships. Even though MSC gave U.S. charters preference, the ready availability of militarily useful ships of foreign flag resulted in the charter of large numbers of them. Generally, the delay between the date of charter and the ship's arrival at the port of embarkation was less than the delay between the activation order for an RRF ship and its arrival at port.

Must We Rely on Foreign Charters?

The use of foreign charters worked well in Desert Shield/Storm. Can the U.S. rely on them in other crises? There is really no answer to that question. The military has traditionally been reluctant to plan on chartered ships for sealift—hence the existence of the RRF. But is the RRF big enough? To shed some light on this question, the study considered the following: Could the present RRF, if it activated as its readiness categories indicate it should (5, 10, and 20 days), have made at least as many deliveries to the theater as the combination of the RRF and

foreign-chartered ships actually did in Desert Shield/Storm? That is, could the RRF, if functioning to its advertised potential, offset the loss of the foreign-flag ships?

The results of this analysis suggest that an RRF of the present size, if activated on time, could have made up for the loss of foreign charters in Phase I. To achieve this capability, the maintenance practices and activation procedures for the RRF ships presumably would have to be improved to ensure on-time activations. If faster delivery rates were desired, such as those that occurred in Phase II, the RRF could not have filled the shortfall.

Sustainment Shipping

Although the focus of attention was on the lift of unit equipment and the initial deployment of the combatant force, sustaining dry cargo, ammunition, and petroleum, oil, and lubricants (POL) were delivered by sea and constituted a major share of the sealift operation. Sustaining dry cargo was largely containerized and shipped under the terms of a Special Middle East Support Agreement (SMESA) negotiated by MSC with U.S. commercial ship operators. SMESA provided for the shipment of up to 2,700 40-foot containers per week in multiple sailings from U.S. ports. A standby agreement to provide fully dedicated service was also negotiated but not required. These shipments of sustainment cargo represented a vital, but little recognized, contribution of the U.S. merchant marine to the success of Desert Shield/Desert Storm.

Transport of ammunition was also a major task. A considerable tonnage of ammunition was deployed in the initial surge, and the requirement grew exponentially after the fighting started. At the time of the cease fire, more than 100 ships were committed to the ammunition lift.

Large quantities of POL were sealifted to the Persian Gulf, CONUS, and Europe in support of Desert Shield/Storm. The airlift operation required fuel, both in CONUS and in Europe, as did sealift and U.S. Navy combatant ships, and aircraft and amphibious and support ships. Tankers actually delivered more Desert Shield/Storm-related fuel to sites in CONUS and in Europe than to the Persian Gulf, largely because refined petroleum products are plentiful in Saudi Arabia and sizable quantities were made available to coalition forces. Saudi Arabia also imported fuel in chartered tankers; these deliveries were not a part of the U.S. sealift effort. Fuel was also delivered via pipeline and in tank trucks in Saudi Arabia, and to meet requirements in CONUS and Europe.

MSC provided tankers to deliver fuel worldwide in support of the operation as well as continuing to deliver fuel to meet other defense requirements. To do so, the tanker fleet was increased from 22 in early August 1990 to 48 by February 1991. During that same period, the number of tankers supporting Desert Shield/Storm grew from 12 to 27. Inventories of jet and diesel fuels in the Persian Gulf area remained adequate and grew throughout the operation.

Planning and Execution

As Desert Shield commenced, there was no contingency plan that fit the situation precisely. Those plans that did exist either had been judged infeasible from a transportation perspective or had not been examined for feasibility. Thus, the Time-Phased Force Deployment Data (TPFDD) had to be developed as the operation unfolded. Throughout most of Phase I, requirements grew steadily, increasing almost threefold between 16 August and 24 September. The uncertainty as to requirements, and the fact that many RRF ships did not activate as scheduled, complicated the planning and execution of the sealift operation in Phase I. In Phase II, such problems were minimized because there was some warning time so that planning could begin early, and because there was a pool of ships already activated or chartered.

MSC, the Military Traffic Management Command (MTMC), and deploying units coordinated their actions to help ensure that ships and cargo arrived at ports at approximately the same time. This makes it difficult to form judgments about whether ships were spending significant time waiting for cargo, or whether cargo was backlogged waiting for ships. However, to the extent that RRF activations (or others) were slower than anticipated, it can be inferred that cargo could have been shipped earlier.

The available evidence indicates that sealift was indeed much more responsive in Phase II than in Phase I. In Phase I, cargo was immediately available for loading when the ship arrived in port in 53 of 76 reported instances. Thus, either the cargo was at the port before the ship arrived, or they both arrived simultaneously (as MTMC and MSC planned). In Phase II, on the other hand, cargo was not immediately available for loading in 128 of 178 reported instances in the four major European ports. This implies that there was delay in assembling cargo at the ports in Phase II.

An excursion to examine what the buildup rate of war material in theater would have been if the RRF had activated on time shows some improvement in

building up combat power ashore. For example, the Third Armored Cavalry Regiment might have achieved 80 percent of its buildup by about C+50 as opposed to C+60. (This study did not examine what implications an increased buildup rate might have for airlift requirements, transportation to ports of embarkation, or port loading and throughput.)

OBSERVATIONS BASED ON THE SEALIFT OPERATION

- Desert Shield involved the most rapid buildup of U.S. military might in a foreign theater since Korea. Sealift programs designed in the early 1980s—the Afloat Prepositioning Force, the Ready Reserve Force, and fast sealift ships—proved their worth by allowing rapid response to a no-warning crisis in the theater most remote from the United States.
- There was considerable confusion in both phases of Desert Shield/Storm about lift requirements and priorities. Such turmoil and confusion will probably always be part of a real world, no-notice contingency. Assuming that speed of response is of major importance in such operations, two steps should be considered:
 - Issuing immediate activation orders for more of the RRF than originally deemed necessary.
 - Immediately putting out requests for proposals (RFPs) for charters to
 - (1) determine how responsive the charter market will be, and
 - (2) hedge against problems with the RRF activations.
- The Afloat Prepositioning Force (MPS and PREPO ships) worked much as planned. Because these ships were well positioned relative to the scene of action, their response was excellent. A subject for investigation might be to what extent even more reliance could be placed on such forces.
- The Ready Reserve Force is a necessary hedge against the possibility that chartered or requisitioned ships might not be available, or might not be enough to lift the force. For operations of about the size of Phase I of Desert Shield, analysis suggests that the RRF is about the right size to provide such a hedge. However, in Desert Shield/Storm its responsiveness fell much below advertised levels. The maintenance practices, readiness standards, and composition (both age and type) of the RRF need more examination.

- The fast sealift ships did more, relative to their numbers, than any other type of sealift asset. That performance was due to their large size and speed. On the initial trip, *Antares* broke down and did not contribute to the force buildup. The remaining seven ships responded much as planned, although speeds on the initial trip, about 23 knots, were lower than generally advertised. Speeds improved thereafter, and FSSs averaged 27 knots for the entire operation.
- Roll-on/roll-off ships played a major role. They are easier and quicker to load and are generally larger than other ships.
- Charters, particularly foreign charters, were used extensively. They were more responsive than RRF ships and much less expensive. The evidence is that, at least in internationally supported operations like Desert Shield/Storm and in situations where there is no interdiction threat to sealift, many foreign charters will be available.
- The ability of the U.S.-flag merchant marine to contribute to sealift in a contingency is increasingly limited to sustainment shipping (dry cargo and POL) and to providing a pool of maritime labor to man reserve ships, if and when they are activated.
- Saudi Arabian ports, airfields, and contingency bases were excellent. Facilities in most other areas of the world will not be as accommodating.

OUTLINE OF REPORT

The next section reviews the sealift assets available to the United States as Desert Shield commenced. It also briefly reviews the planning process and discusses the execution of sealift operations in Desert Shield/Storm. The following section examines what actually happened. Each element of the sealift is considered, and data are presented on its responsiveness and contribution to the overall effort. The last section considers whether the sealift operation could have been speeded up significantly and whether the RRF is sufficiently large to undertake such contingencies without the use of foreign charters. Appendixes present detailed data.

THE SEALIFT TASK IN DESERT SHIELD/STORM

The task facing U.S. sealift assets during Desert Shield/Storm was formidable. During Phase I, the job consisted of moving most of the equipment and combat service support for about three Army divisions from ports in the United States to ports in Saudi Arabia and the Persian Gulf region. (A fourth division, the 82nd Airborne, came by air.) That sea line of communication is considerably longer than those of the Vietnam or Korean Wars. In addition, Army, Air Force, and Marine equipment in the Afloat Prepositioning Force had to be moved to Saudi Arabia. During Phase II, the major task was to move U.S. forces from the European Theater to Saudi Arabia in addition to continuing sealift from the U.S. The following section describes the assets that were available to do the job. Then the planning and execution of the sealift operation are reviewed.

LIFT ASSETS

The assets available to tackle the job included both active and inactive ships, some initially controlled by the Military Sealift Command (MSC), by commercial operators, and by the Maritime Administration (MARAD).

Afloat Prepositioning Force

The Afloat Prepositioning Force (APF) consists of two components: maritime prepositioning ships (MPSs) and prepositioning ships (PREPO ships). The MPS force consists of 13 ships in three squadrons that carry the equipment and 30 days of supply for three Marine Expeditionary Brigades (MEBs). The ships are fully loaded and manned in peacetime, and are operated under charter to MSC. The MPS squadrons are based on Diego Garcia, Guam, and the east coast of the U.S. These ships and their cargo undergo scheduled maintenance and periodically participate in exercises. Thus, on any particular day, not all 13 ships will be located at the prepositioning sites or immediately available. Those on site should be able to respond immediately when ordered to sail. They have a nominal speed of 15 knots. Once these ships offload their initial cargos, some may revert to common-user status.

The PREPO force consists of 12 ships carrying ammunition and other supplies for the Army and Air Force, fuel, and a naval field hospital. Eight are dry-cargo ships, and four are tankers. Like the MPS these ships are prepositioned overseas, 11 at Diego Garcia and one in the Mediterranean. They are under contract to MSC

and fully manned in peacetime by civilian crews. They have nominal speeds of advance of 16 to 20 knots and, when not in major maintenance, should be able to respond immediately when ordered to sail.

Fast Sealift Ships

The fast sealift ships (FSSs) are eight SL-7 container ships purchased from Sea Land Corporation, which have been converted by the Navy to a roll-on/roll-off (RO/RO) configuration for rapid movement of military equipment and supplies. These ships are berthed at U.S. ports on the Gulf of Mexico and along the eastern seaboard. The FSSs are maintained in a reduced operating status (ROS) with partial crews and should be ready to sail within four days after receiving an activation order. FSSs are nominal 30-knot ships, about 10 knots faster than most other sealift ships. Together, they can move the unit equipment of an Army division. Like MPS and PREPO ships, FSSs undergo scheduled maintenance and participate in exercises that could slow their reaction to an activation order.

Ready Reserve Force

The Ready Reserve Force (RRF) is a fleet of militarily useful ships that were purchased by the Navy in the 1980s. The RRF consists of 96 ships, including 17 RO/ROs, 48 breakbulk cargo ships, and an assortment of others like tankers and barge carriers. In peacetime, RRF ships are laid up in a nonoperational status under the control of MARAD. When called up, ships must be towed to a nearby shipyard for mechanical preparations, and crews must be drawn from available U.S. merchant mariners before the ship is turned over to MSC for operation. The ships in the RRF are split into three groups: those that should be able to activate within 5 days, within 10 days, and within 20 days. As Desert Shield began, 65 ships were in 5-day status, 28 were in 10-day status, and 3 were in 20-day status.

Commercial Charter

In addition to the above sealift resources under direct U.S. government control, MSC can charter ships from the commercial fleet. At the start of Desert Shield, MSC had about 10 dry-cargo ships and 20 tankers from the U.S. merchant fleet under long-term charter. In all, 28 U.S.-flag charters (including six of the ships already under long-term charter) were used to transport unit equipment (and related support) in Desert Shield/Storm.

MSC can also charter foreign-flag ships. Some of these ships are actually U.S.-owned ships flying a flag of convenience. These ships are termed effective U.S. controlled (EUSC) ships. Although a large number of foreign-flag ships were used in Desert Shield/Storm, only one dry cargo ship and one tanker were EUSC ships.

Sealift Readiness Program

If necessary, MSC can draw on ships in the Sealift Readiness Program (SRP). All U.S.-flag shipping companies that receive operating differential subsidies must commit at least half of their ships to the SRP. In addition, all carriers who compete for Department of Defense cargos must commit 50 percent of their U.S.-flag vessels to the SRP. The SRP ships can be called to action by the Secretary of Defense via the Secretary of Transportation. Currently 96 ships are in the SRP. If the President declares a state of emergency, MARAD can also requisition additional ships from the U.S.-flag fleet. The SRP and requisitioning were not employed to support Desert Shield/Storm because suitable ships (RO/ROs and breakbulk ships) were available for charter.

REQUIREMENTS PLANNING AND SEALIFT EXECUTION

The United States Transportation Command (USTRANSCOM) is responsible for providing air, land, and sea transportation to support U.S. military forces. USTRANSCOM's mission is to support the geographic commanders in chief (CINCs). In Desert Shield/Storm, the supported CINC was the Commander in Chief of the U.S. Central Command (CINCCENT).

The CINC is responsible for determining requirements for troops, supplies, and equipment to support operation plans and contingency plans. Each plan includes the size and composition of the forces that will be employed, as well as their required destinations and arrival times, expressed as latest arrival dates. This information is documented as Time-Phased Force Deployment Data (TPFDD) in the automated Joint Operations Planning and Execution System (JOPES). A key part of the TPFDD process is the determination of transportation requirements. With these requirements in hand, USTRANSCOM assesses whether the CINC's plans are feasible. If they are not, the CINC must revise the plans so that they can be supported with the airlift and sealift that is expected to be available.

If a plan is executed, transportation is provided in accordance with the cargo priorities set by the CINC in the TPFDD. USTRANSCOM provides general

management and direction for the transportation effort, which is actually executed by its three component commands. The Military Airlift Command (MAC) is responsible for air transportation, MSC is responsible for sealift, and MTMC has responsibility for moving troops and cargo within the U.S. to airports of embarkation (APOEs) and seaports of embarkation (SPOEs) and for loading and handling at those embarkation points.

There was no contingency plan that precisely fit Desert Shield. The closest—OPLAN 1002-88—was in the process of revision. The TPFDD for 1002-88 had been assessed as “not transportation feasible.” The successor plan—OPLAN 1002-90—had not been approved, nor had the TPFDD been examined for transportation feasibility. Nevertheless, this TPFDD was promulgated as the applicable directive for Desert Shield. MSC and MTMC had two major problems with this TPFDD:

- It was inaccurate with respect to identification of units to be lifted, their cargo requirements, and ports of embarkation. The problem was particularly severe with respect to combat support and combat service support (CS/CSS) units. Literally hundreds of reserve units were included in the TPFDD that were never alerted and never called.
- Dates specified for in-theater arrivals were unrealistic, particularly in view of the fact that Desert Shield commenced with little warning time.

As modifications to this TPFDD occurred during Phase I, unit priorities and total requirements changed markedly. The end result was that, through most of Phase I and despite the best efforts of all the participants, the TPFDD was not useful either for scheduling and allocating the available sealift in the short run or for planning the overall procurement of sealift in the long run.

Lacking a useful TPFDD, MSC and MTMC became more reliant on inputs from the operational units themselves. These requirements, however, changed rapidly as additional units were added to the deploying force. They also tended to be defined when the units were ready to move, or close to it, and therefore allowed little lead time. The process was further complicated by the rapid growth in requirements—particularly in CS/CSS—and by the delays in activation of the RRF ships. MSC policy and efforts were directed to ensuring that there would be ships available in every port where there was cargo to load and that, once commenced, the loading process would be continuous until completed.

The increases in requirements as seen by MSC during Phase I are illustrated in figure 1. Each bar represents the total requirement that had been identified by MSC as of the given date. The figure shows that the projected requirement grew steadily throughout August and September, nearly tripling in size.

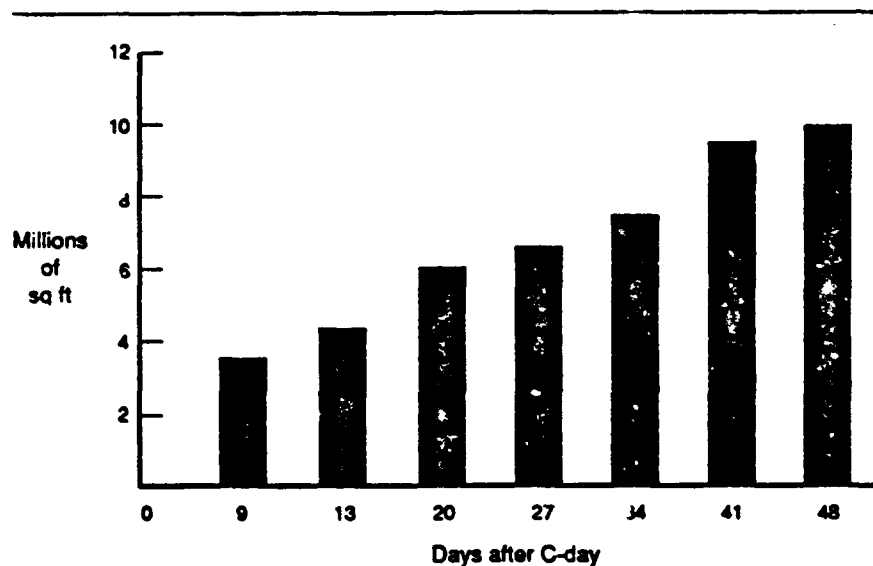


Figure 1. Increases in requirements for sealift capacity, Phase I

Planning and execution in Phase II differed from Phase I in at least two aspects:

- There was significant lead (warning) time in Phase II, whereas there was little in Phase I. Planning commenced in mid-October, and the decision to reinforce was announced on 7 November.
- MSC had a sizeable pool of active shipping available at the beginning of Phase II, which had not been available at the beginning of Phase I: 7 FSSs, 4 MPSs, and 6 PREPO ships in the common user pool, 39 RRF ships, and 45 ships under charter.

These two factors worked to make sealift more quickly responsive in Phase II than in Phase I.

Nevertheless, in Phase II there was again difficulty in defining specific requirements—the units to be moved and their locations, cargo requirements, and

availability dates. As in Phase I, the requirements changed rapidly and sizably, as indicated in figure 2. Cargo growth generated a need for additional shipping, as did compression of the time available to move the force (precluding second voyages planned for a number of ships). There was also a requirement to move equipment, made excess by the Conventional Forces in Europe agreement, out of Europe no later than 17 November. Much of this equipment ultimately went to Saudi Arabia, but it represented a competing requirement for sealift and for inland transportation, and it certainly complicated the planning problem, including the definition of Phase II requirements.

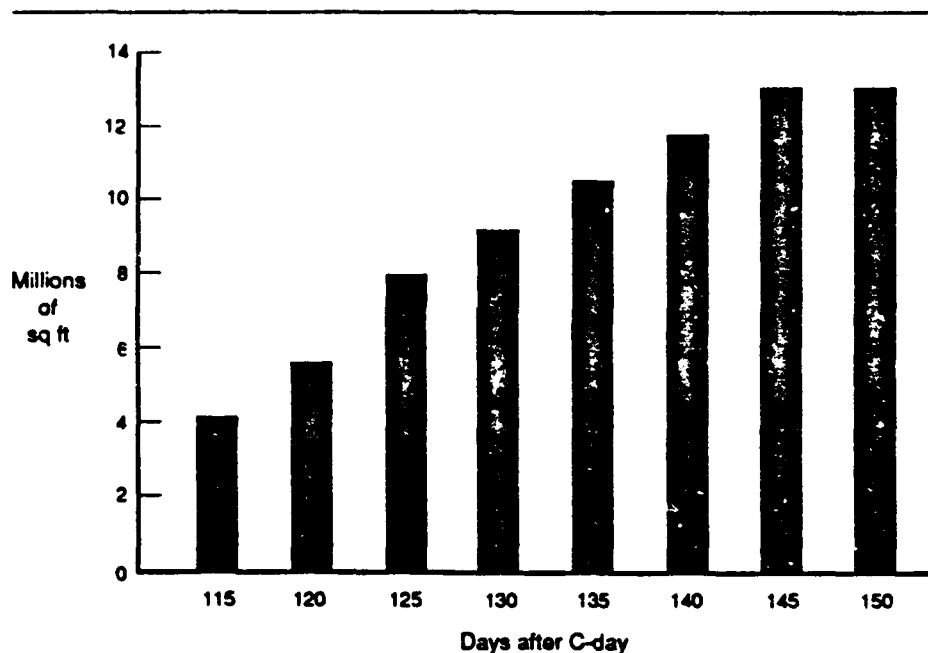


Figure 2. Increases in requirements for sealift capacity, Phase II

Some indication of the relative responsiveness of sealift in Phases I and II can be seen in table 4. That table shows the average number of days in which there was no ship at a major SPOE for comparable periods of Phase I and Phase II. It also indicates the average number of ships in each port each day. Obviously, sealift assets were at SPOEs earlier and in greater numbers in Phase II than in Phase I.

Table 4. Sealift assets at major SPOEs^a

	Phase I		Phase II	
	First 14 days ^b	Next 50 days ^c	First 14 days ^d	Next 50 days ^d
Average number of days with no ship in port	8.6	14	3.8	.3
Average daily number of ships in port	0.7	1.7	2.0	3.1

a. Based on data in appendix B.

b. Includes Savannah, Jacksonville, Wilmington, Houston, and Beaumont.

c. Does not include Savannah. No cargo was moved through Savannah after day C+19.

d. Includes Rotterdam, Norderham, Antwerp, and Bremerhaven.

But were ships arriving fast enough, even in Phase II, to keep up with the arrival of cargo at the SPOEs? Table 5 sheds some light on that issue. The table shows the number of instances in which cargo was immediately available for loading when ships arrived at SPOEs and those in which the ship arrived before the cargo was available for loading. Data were not available for all port arrivals, but the comparison between Phases I and II is nevertheless revealing. In Phase I, cargo was available for loading when the ship arrived in port 70 percent of the time (53 of 76 instances). Thus, in those cases, either the cargo and ship arrived at the port nearly simultaneously (as MTMC and MSC planned) or the cargo arrived before the ship. If the latter, earlier ship arrivals could have reduced the time to get cargo to Saudi Arabia assuming, of course, that berths were available for the ship when it arrived).

In Phase II, on the other hand, cargos were immediately available for loading for only about 34 percent of the ship arrivals. More specifically, at the major European ports, cargo was not available for loading when the ship arrived over 70 percent of the time.

Tables 4 and 5 suggest that sealift was just keeping up with or perhaps lagging cargo arrivals at the ports in Phase I. (The available data did not allow determination of which of these two cases was prevalent.) In Phase II, this tendency reversed. Sealift was available early on and, in general, ships arrived in port before cargo was available for loading.

Table 5. Instances in which cargo was immediately available for loading or was delayed after ship arrival in port

	Cargo available		
	Immediately	1 to 5 days	More than 5 days
Phase I			
U.S. east coast and Gulf coast ports	53	23	0
Phase II			
U.S. east coast and Gulf coast ports	43	40	9
European ports	50	100	28
Total Phase II	93	140	37

SOURCE: [4].

EXAMINATION OF THE SEALIFT OPERATION

This section documents what sealift accomplished and how effective the operation was relative to reasonable expectations. The sealift task consisted of three components: the movement of unit equipment and combat support cargo, the delivery of sustaining dry cargo under the Special Middle East Shipping Agreement, and the delivery of POL.

WHAT WAS ACCOMPLISHED?

The buildup of surge-phase dry cargo (equipment and related supplies) is shown in figure 3. Delivery of Phase II cargo started around C+120 (early December). By the end of Phase II (C+195) it totaled about 30 million square feet. More cargo was shipped in Phase II than in Phase I (about 16 million square feet), and the time to deliver it was shorter.

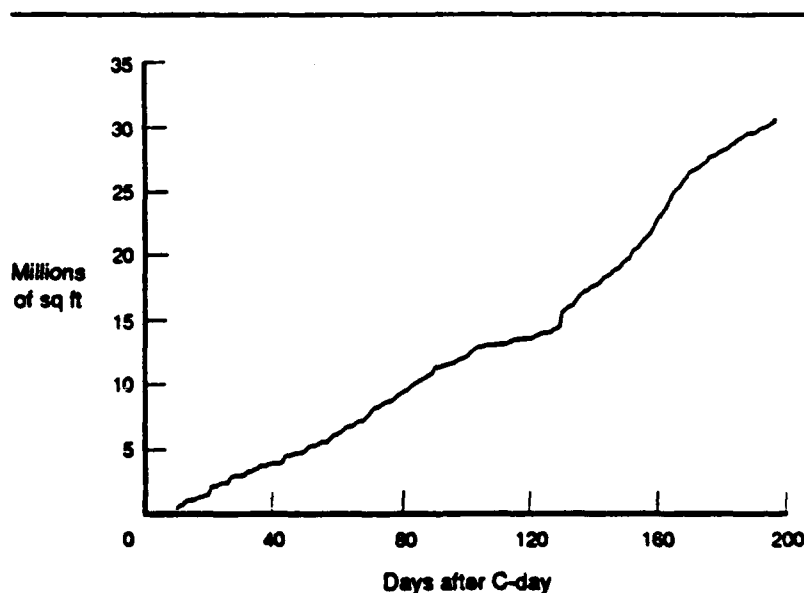


Figure 3. Unit equipment and support cargo delivered by sealift

Figure 4 shows the buildup in Phase I of major Army and Marine units, indicating when 50, 80, and 100 percent of the unit's sealifted equipment arrived in Saudi Arabia. Since the airlift of other equipment and personnel was timed to

coincide roughly with the sealift arrivals, the 100-percent date on the chart is a good approximation of when that unit was at full strength. The first units to achieve full strength were the 1st Marine Expeditionary Brigade (MEB) and the 82nd Airborne Division (arriving by airlift and not shown on the chart), both about C+25. The last combat unit to complete Phase I deployments was the 1st Cavalry Division, finishing on C+76. The Corps Support Command (COSCOM) equipment did not complete deployment until about C+113. MPS Squadron Three delivered its equipment between C+18 and C+24. In addition to the units shown on the chart, the 4th MEB arrived on amphibious ships about C+40.

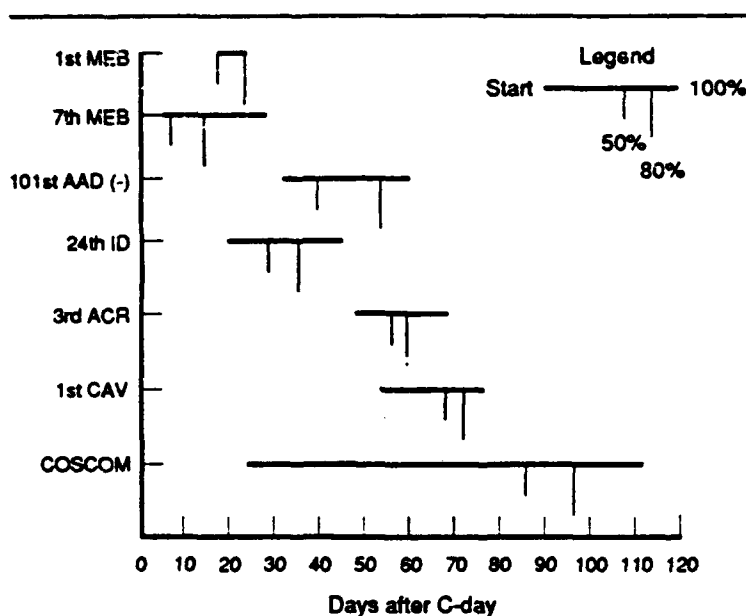


Figure 4. Actual Phase I unit and support equipment deliveries by sealift, percentage over time

Another three plus Army divisions arrived by sea in Phase II. The 1st and 3rd Armored Divisions came from Europe, and the 1st Infantry Division and 2nd Armored Cavalry Regiment came from CONUS. Equipment for the 6th MEB arrived on MPS ships, and II MEF was sealifted from CONUS. The closure of these units is depicted in figure 5.

Arrival of ammunition is shown in figure 6. Ammunition deliveries spiked sharply upward about C+160, coincident with the start of Desert Storm hostilities. A large quantity (50 ships) of ammunition was in transit at the cease fire.

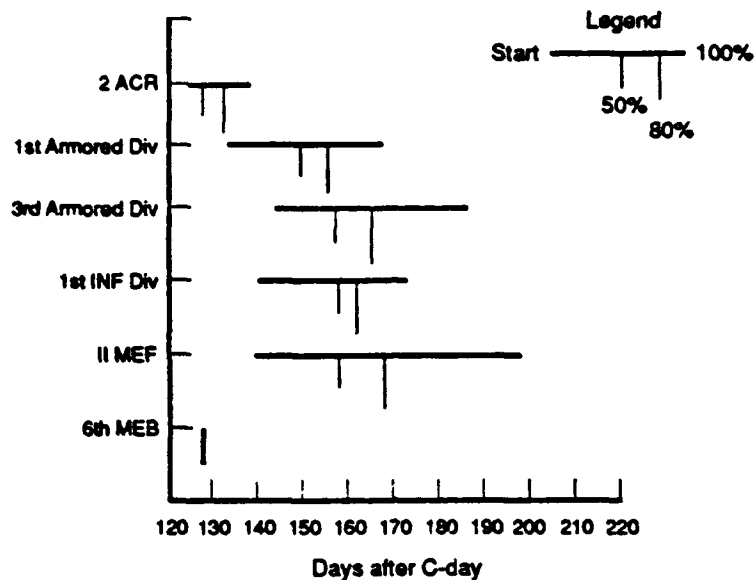


Figure 5. Actual Phase II unit and support equipment deliveries by sealift, percentage over time

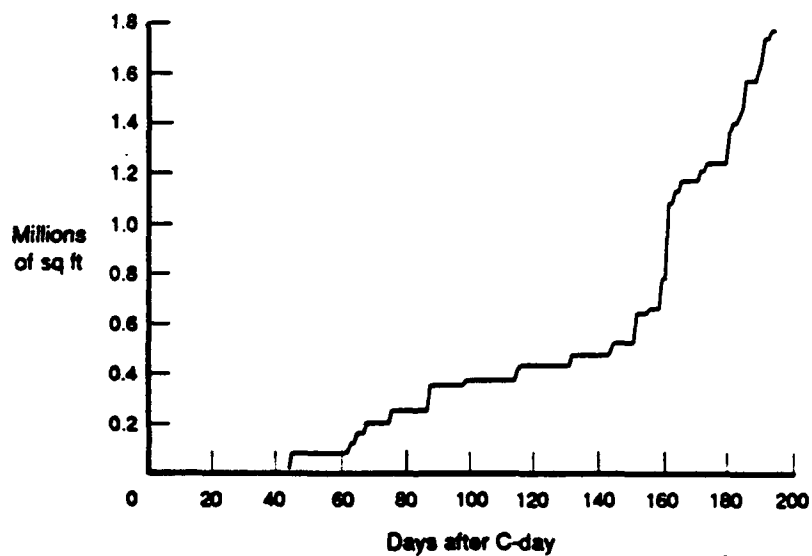


Figure 6. Ammunition delivered by sealift

Sustainment cargo, other than ammunition and POL, was delivered largely by U.S.-flag ships in commercial service under terms of the SMESA. This agreement, negotiated by MSC with the major U.S.-flag operators in September, provided for the carriage of some 2,700 containers per week in multiple sailings from both the east and west coasts of the United States. Cargo was shipped in regularly scheduled liners of the participating companies from CONUS to an overseas collection point where it was transshipped to feeder ships, either U.S. or foreign flag, and then went directly to Saudi Arabia. The system worked extremely well and, at some points in time and over some parts of the transit, it functioned essentially as a dedicated service. SMESA was a little recognized, but crucial, contribution of the U.S. merchant marine to the success of Desert Shield/Desert Storm. Deliveries of sustainment cargo, less ammunition, are shown in figure 7.

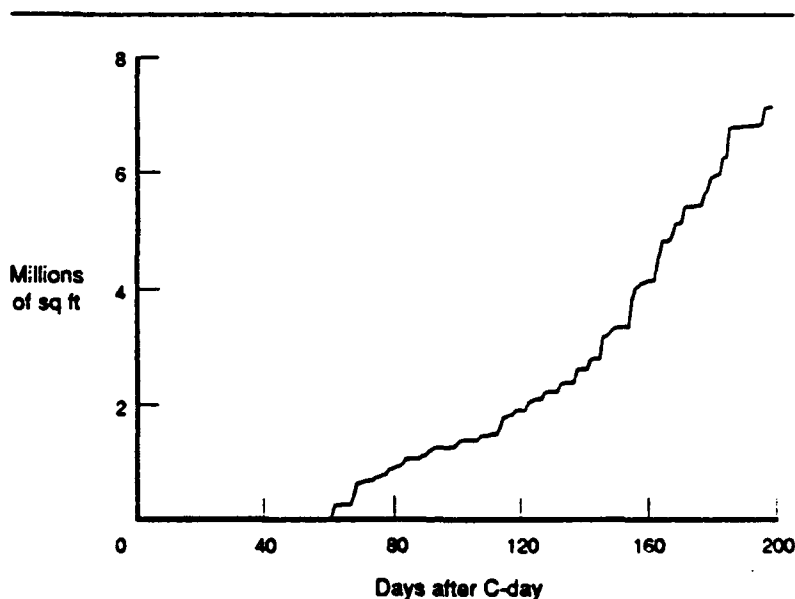


Figure 7. Sustainment cargo delivered by sealift

While tankers under the operational control (OPCON) of MSC delivered lots of fuel in support of Desert Shield/Storm (about 35 million barrels), sizable amounts were also provided by Persian Gulf states, especially Saudi Arabia. Fuel from local refineries did not necessarily move via tanker; it was also shipped via pipeline and truck. Saudi Arabia also contracted to import refined products, which were delivered in tankers that were not part of U.S. sealift activity. Fuel delivered to the Persian Gulf on tankers under MSC OPCON is shown in figure 8.

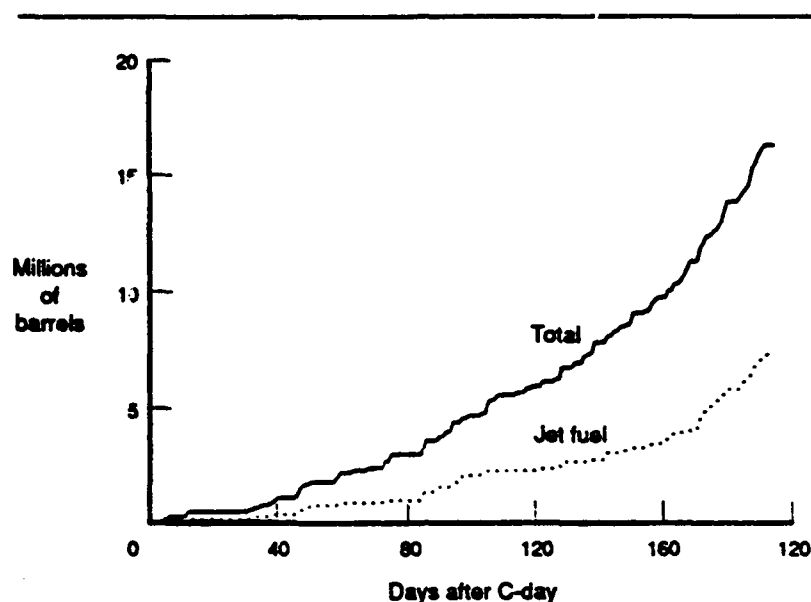


Figure 8. POL deliveries by MSC tankers to Persian Gulf (Desert Shield/Storm support)

Not all the POL lifted in support of the operation went to the Persian Gulf. Figures 9 and 10 show Desert Shield/Storm-related deliveries made by tankers to locations in CONUS and Europe, respectively. They reflect fuel for airlift out of CONUS and Europe and for Navy ships and sealift ships.

CONTRIBUTION OF SEALIFT TO DELIVERIES OF UNIT EQUIPMENT

Figure 11 displays the buildup of combat and support equipment in Phase I of Desert Shield, broken down by which sealift asset delivered it. It shows that MPS and PREPO ships began making deliveries within about 10 days, with FSSs beginning deliveries about 20 days into the operation. Other sealift assets began arriving at about C+30.

Figure 12 shows the amount of combat and support equipment cargo delivered by each category and type of ship employed during Phase I. The prepositioned cargo carried by the MPS and PREPO ships accounted for about 17 percent of the total. The remaining 83 percent came primarily from the United States. About 70 percent of the total was delivered by ships of the MPS, PREPO, FSS, and RRF fleets. Figure 13 shows the same data for Phase II. Charters accounted for more than half of the cargo delivered.

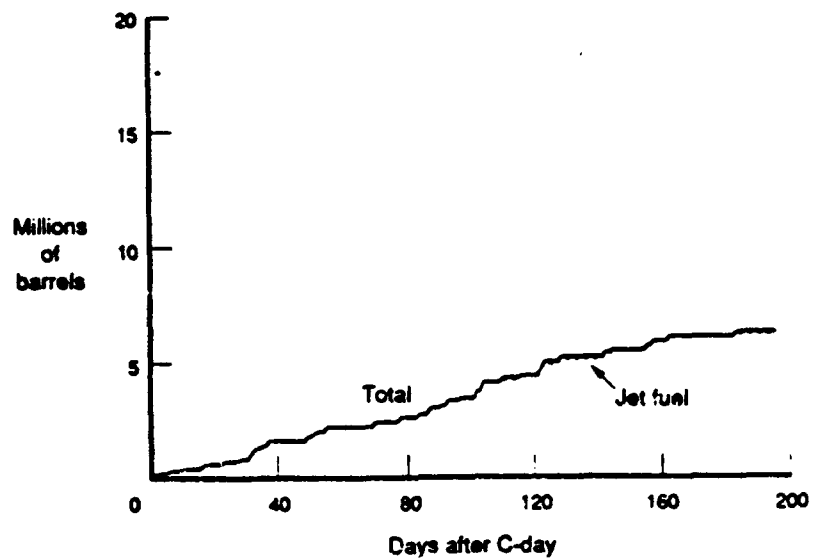


Figure 9. POL deliveries by tankers to CONUS (Desert Shield/Storm support—virtually all deliveries were jet fuel)

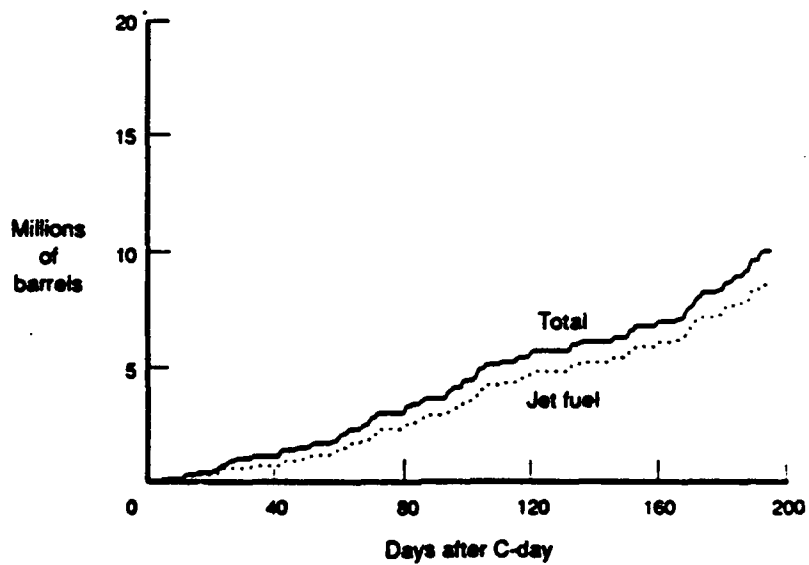


Figure 10. POL deliveries to Europe by tanker (Desert Shield/Storm support)

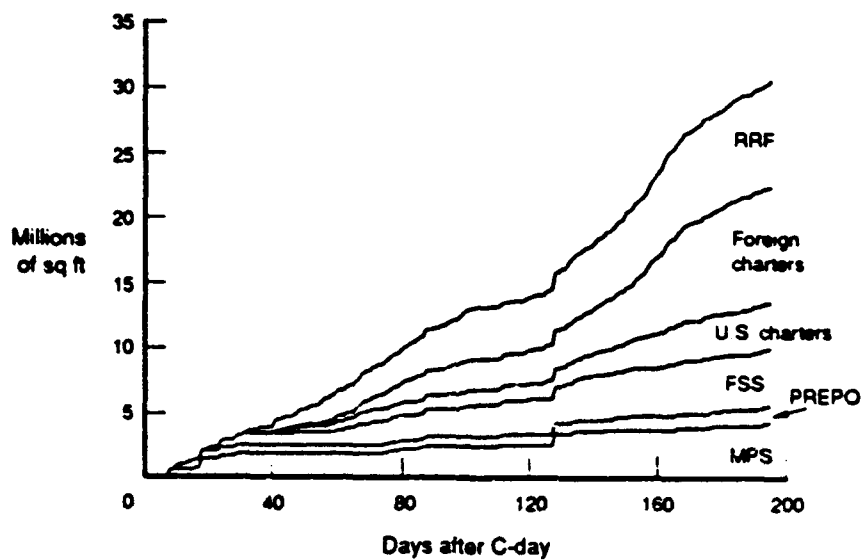


Figure 11. Cumulative cargo delivered in Phase I by each sealift asset

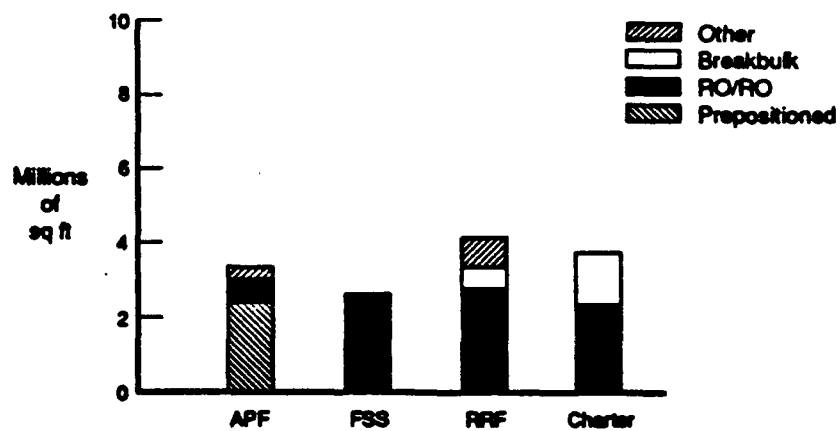


Figure 12. Unit equipment and related support cargo delivered in Phase I, by ship type

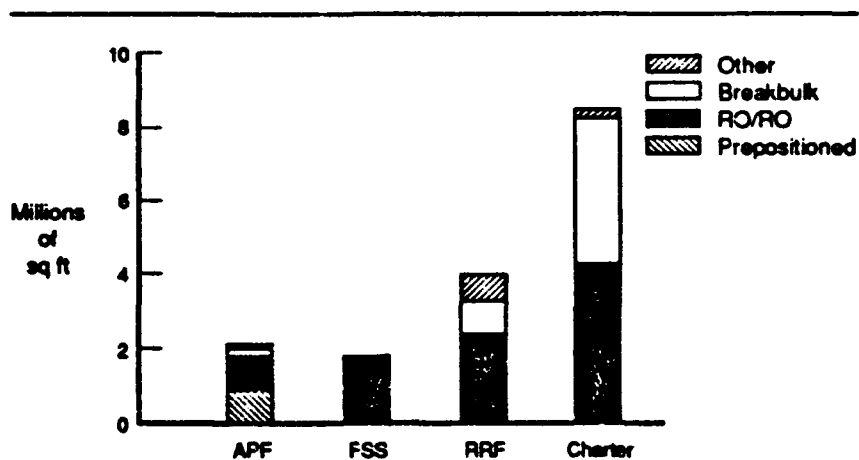


Figure 13. Unit equipment and related support cargos delivered in Phase II, by ship type

RO/RO ships carried about twice as much combat and support equipment in Phase I as all other ship types combined. In Phase II, RO/ROs carried more than half of these cargos. In general, RO/ROs are preferred for carrying unit equipment because they are larger and because they are easier to load and unload, thus reducing their time at the berth. The RO/ROs in the RRF average about 110,000 square feet carrying capacity, whereas the RRF breakbulk ships average only about 40,000 square feet. The chartered RO/ROs were somewhat smaller, with capacities averaging about 75,000 square feet, but were still larger than most breakbulk ships by 25,000 to 35,000 square feet. RRF RO/ROs were loaded in an average of slightly over three days, while breakbulks averaged between five and six days.

Table 6 provides breakdowns of ship activity during each phase of Desert Shield/Storm by sealift component. Five of the FSSs, due to their high speeds, were able to complete three deliveries in Phase I; no other ships were able to do so. As a result of their speed and size (150,000 square feet), the seven operational FSSs carried about 20 percent of the unit equipment in Phase I (figure 12). In Phase II, however, they carried only about 12 percent (figure 13). None made more than two deliveries because the operation had to be completed in a shorter period.

Chartered ships delivered more than half of the combat and support equipment in Phase II (figure 13), up from about 30 percent in Phase I (figure 12). Large numbers of charters (114) made only one delivery in Phase II because second trips were largely precluded due to the compressed period in which deliveries had to be

completed. The need for numerous ships to make only one trip is why so many ships were chartered in Phase II.

Table 6. Ship utilization in Phase I and Phase II

	MPS	PREPO	FSS	RRF	Charters	
					U.S.	Foreign
Phase I ships making:						
One delivery	3	4	0	27	12	42
Two deliveries	6	4	2	11	5	3
Three deliveries	0	0	5	0	0	0
Phase II ships making:						
One delivery	5	5	2	35	22	114
Two deliveries	3	0	5	12	6	5
Three deliveries	0	0	0	0	0	0

RRF ships delivered about 25 percent of the unit equipment (and related support) in Phase II, down from about 30 percent in Phase I. It is noteworthy that only 47 of 70 RRF ships completed a delivery (or two) in Phase II. Twenty-three RF ships failed to complete a delivery in Phase II. Eight of these ships had been activated in Phase I, and the other 15 had been called up in Phase II. Of the eight Phase I ships, three were returned to MARAD because of mechanical difficulties, three were transferred from common-user to withhold shipping, where they served as Combat Logistics Force (CLF) ships, and two eventually made a delivery after C+195. Of the 15 Phase II ships, three served as CLF ships, three were not directed to activate until it was too late to complete deliveries by C+195, four incurred activation delays, and five were returned to MARAD due to mechanical problems.

Maritime Prepositioning Ships

Nine MPSs were ordered to sail immediately at the start of Desert Shield. Five, supporting the 7th MEB, are normally positioned at Diego Garcia. On 7 August, one of those ships was at Norfolk, Virginia, undergoing scheduled maintenance and upkeep. That ship went to Blount Island, Florida, to onload Marine equipment and sailed for Saudi Arabia on C+5, arriving at her designated port of debarkation on C+29. Given her location and status, she arrived as soon as could be expected.

(Expected steaming time for an MPS ship between the east coast and Saudi Arabia is about 25 days.) Another Diego Garcia ship was enroute to Blount Island on C-day and had to return, refuel, and sail for Saudi Arabia, which she did on C+9, arriving at her destination on C+16. The other three ships in Diego Garcia sailed on C-day and arrived in Saudi Arabia on C+8.

The four MPSs normally positioned in Guam and supporting the 1st MEB were also deployed immediately. One was participating in an exercise on the West Coast and arrived at its port of debarkation on C+24. The other three ships responded immediately and arrived on C+18.

In Phase II, the MPS squadron positioned in Morehead City, North Carolina, deployed. The ships left port on C+100 and arrived in theater 28 days later.

The MPSs responded much as anticipated. Three ships were out of position on C-day, but that was a normal occurrence for active ships which must undergo maintenance and exercise their capabilities.

Prepositioning Ships

Eight PREPO ships were ordered to get underway on August 9 (C+2). Seven were in Diego Garcia and got underway immediately, arriving at their destinations between C+10 and C+14. The eighth, located in the Mediterranean, also responded immediately, arriving on C+13. These ships also met expectations, delivering cargos on time. Five of the eight ships made subsequent deliveries. Four tankers in the PREPO force also participated.

Fast Sealift Ships

Three FSSs were ordered to sail on C-day and the remaining five on C+1. Five were underway after four days, their nominal response time. One, *Regulus*, was one day late responding, and another was three days late. *Denebola* was in overhaul and took nine days to respond. The first ship loaded and sailed for the Persian Gulf by C+6. All departed their SPOEs by C+15. FSSs began arriving in Saudi Arabia on C+20. Seven arrived by C+31. *Antares* sailed, even though scheduled maintenance

had been deferred.¹ After a series of boiler casualties, she put in to Rota, Spain, for repairs. *Altair* picked up *Antares*' cargo at Rota after delivering her own. Thus the last initial FSS delivery was made on C+47. In subsequent Phase I operations, the seven operational FSSs made a total of 11 additional deliveries. Over the entire operation, the FSS fleet has made 31 deliveries, an average of more than four per operating ship.

Overall, the FSSs performed well. The *Antares* breakdown delayed completion of the first wave of FSS-delivered material by about 16 days. Loading went much as anticipated, taking about three days each. The transit to Saudi Arabia was slightly slower than expected. On the initial trip, the seven ships that completed the voyage averaged about 23 knots. However, for the entire operation, the FSS fleet averaged about 27 knots.

If everything had gone perfectly, FSSs would have responded in four days, sailed to their SPOEs, taken two to three days to load, and then transited in about 14 days. Given their actual call-up dates and actual transit times to the SPOEs, all eight ships should have arrived at their ports of debarkation between C+21 and C+29. (This assumes that the one ship in overhaul would take, as it did, five additional days to respond.) Six of the eight ships made this time schedule. (Two were actually ahead of schedule due to faster-than-expected activation times.) Two, including *Antares*, did not.

Ready Reserve Fleet

Activation orders for the RRF began on C+3 when 18 ships (including 17 RO/ROs) were called up. Five more (LASH/SEABEEs) received activation orders on C+8, with 15 more ordered up on C+11/12. During Phase I a total of 44 ships were ordered activated. Of those, 37 were ships in the 5-day readiness category, six were 10-day ships, and one was a 20-day ship. In Phase II, an additional 21 ships were ordered activated between C+119 and C+122. Two of these ships had actually been activated for other operations and were diverted to take part in Phase II. Another five ships were ordered activated between mid-December and early February.

1. *Antares* had earlier suffered an electrical fire in her automatic combustion control system. In addition, she was scheduled for regular maintenance on one of the two boilers. That work was scheduled to begin in mid-August and would have delayed her activation for about 90 days. The decision was made to defer the maintenance and take the calculated risk of a breakdown, in order to speed delivery of the equipment.

Activation performance of the RRF is shown in table 7. Of 44 ships activated in Phase I, only about 25 percent were on time, and about half of the ships were more than five days late. In Phase II, only 4 of 26 ships were on time, and more than half were at least ten days late.

Table 7. Timeliness of the RRF (numbers of ships)

	On time	Days late		
		1-5	6-10	More
Phase I				
5-day ships	9	9	10	9
10-day ships	2	3	0	1
20-day ships	1	0	0	0
Phase II				
5-day ships	2	6	2	7
10-day ships	2	1	1	5

Activation of RRF RO/ROs turned out to be especially important; the RO/RO is the ship of choice for transporting unit equipment due to its ease and flexibility of loading and unloading. Relatively few RO/ROs remain in the U.S.-flag commercial fleet, so the RRF RO/ROs were needed at the start of the operation. Only 3 of 17 were activated within five days; most were late by more than five days.

RRF arrivals at the ports of embarkation were also delayed because seven of the ships in the initial callup were located at west coast ports and had to steam to ports on the Gulf of Mexico. For those ships, transit to the SPOE took about nine to ten days longer than for east coast ships.

Table 8 shows the distribution of activation times by age and propulsion plant for the 57 five-day readiness ships called up in Desert Shield. For ships under 20 years of age, steam ships experienced fewer lengthy delays than did diesel-powered ships. This is a fairly surprising result, given the generally greater reliability of diesel engines. (Upon inquiry the study team was told that a possible contributor to this result is the difficulty in maintaining the controller systems on the foreign-built *Cape D* class ships. All are scheduled for \$5 million conversions to replace the controllers with more reliable American-manufactured equipment. Only one of those five ships was activated within five days of its callup.) The table also

shows that older steam ships, as might be expected, were more likely to experience significant delays than newer ships. Although not apparent from the table, this trend seems true for diesels also. Both diesels achieving activation times of five days were 11 years old. Eight of the nine late diesels were 17 to 19 years old. (These conclusions would not change if the table were to include ships activated before and after ten days.)

Table 8. Activation times for five-day RRF ships, by age and propulsion plant

Days to activate:	Steam		Diesel	
	≤ 5	> 5	≥ 5	> 5
Age				
< 20 years	5	5	2	9
≥ 20 years	4	32	0	0
	—	—	—	—
Total	9	37	2	9

Chartered Ships

Chartered ships were readily available and cost effective in Desert Shield/Storm. Most of them also were of foreign flag. Of the 191 ships chartered to carry unit equipment and related support, only 29 were U.S. controlled. Foreign-flag ships were about 70 percent of the charters used in Phase I, and about 85 percent of those used in Phase II. Table 9 shows the amount of unit equipment and support cargos (in millions of square feet) delivered by U.S.-controlled charters and foreign charters. The U.S.-controlled charters account for less than 30 percent of the total.

Charters also were more responsive than RRF ships. In Phase I, when ships usually were needed as soon as possible to accommodate cargo that was ready to load, 24 of 49 ships chartered arrived at their SPOE within 10 days of being chartered. Only 14 of 44 RRF ships arrived at their SPOE within 10 days of receiving an activation order. If RRF ships had activated on time, 26 of 44 would have been at their SPOE within 10 days. The charter experience is comparable to that.

Table 9. Unit equipment and support cargos delivered by chartered ships (millions of square feet)

	U.S. controlled	Foreign flag	Percent U.S.
Phase I	1.32	2.47	35
Phase II	<u>2.27</u>	<u>6.25</u>	<u>27</u>
Total	3.59	8.72	29

Why were charters used so extensively? There were four basic reasons. First, as mentioned earlier, RO/ROs were preferred, and there were only 17 in the RRF. Second, the RRF was slow in activating. Third, there was some worry that crews would be increasingly hard to obtain as more and more RRF ships were activated. Finally, relative to the cost of activating and operating RRF ships, charters are much cheaper. The per-diem charter cost for RO/ROs was averaging about \$23,000. For breakbulk ships, the cost was about \$10,000 per day. (U.S. breakbulks were much more expensive than foreign breakbulks—\$20,000 per day as opposed to \$8,600 per day.) For RRF ships, the daily operating cost was about \$40,000. RRF ships cost an average of \$1.6 million per ship to activate. These ships will also have deactivation costs. In addition, charters are usually made only for a one-way trip. Clearly, charters are less expensive to employ than the RRF. (See appendix C for cost data.)

CONTRIBUTION OF SEALIFT TO THE DELIVERY OF POL

Because of the ready availability of refined petroleum products in the Persian Gulf area, it was not difficult to obtain the necessary tankers to support Desert Shield/Storm. Many of the deliveries of POL by sealift tankers were short transits. Of about 16 million barrels delivered to forces in the Persian Gulf by tankers under MSC OPCON, 75 percent (12 million barrels) also originated in the Persian Gulf area. Likewise, 70 percent of Desert Shield/Storm-related deliveries in Europe originated in Europe and virtually all CONUS deliveries were made from other CONUS locations.

The numbers of tankers completing Desert Shield/Storm deliveries each month are shown by category in table 10. The total number of tankers supporting Desert Shield/Storm rose from 12 in August to 27 in February. Except for February, only a handful of foreign-flag tankers were employed.

Table 10. Numbers of tankers completing a delivery in support of Desert Shield/Storm

	Aug	Sep	Oct	Nov	Dec	Jan	Feb
MSC	10	10	8	11	10	9	8
RRF	0	0	1	1	0	0	0
PREPO	1	3	3	3	1	3	2
Charters							
U.S.	1	1	0	2	6	9	5
EUSC	0	0	0	1	1	0	1
Foreign	0	2	3	4	1	4	11
Total	12	16	15	22	19	25	27

POSSIBLE IMPLICATIONS FOR FUTURE SEALIFT

Desert Shield/Storm was the first real test of the sealift system in many years. As such it provides a baseline for asking questions about the potential of our existing sealift assets in the future. This section addresses two issues: (1) If sealift assets, particularly the RRF, had met their target activation times, how much faster would combat power have arrived in Saudi Arabia? And (2) If foreign charters had, for whatever reason, been unavailable, is the RRF big enough to have offset their loss?

ISSUE: COULD THE SEALIFT OPERATION BE SPEEDED UP?

During Phase I, MSC chose to activate or charter ships based on known requirements, rather than call up excess ships as a hedge against growth in the lift requirements. Clearly, a strategy of gathering excess sealift as early as possible would help eliminate chartering or activation delays later on.

In fact, MSC did just that in Phase II. Identifiable lift requirements about doubled from early November to late December, and MSC procured ships at a rate that kept available sealift capacity even with, or ahead of, lift requirements.

Another way to achieve faster buildup rates would be improving the responsiveness of the sealift fleet (assuming, of course, that MTMC could get cargos to the ports faster, that sufficient throughput and berths would be available at the ports, and that the necessary airlift could keep pace with the sealift). The previous section has indicated that, with a few exceptions, the MPS, PREPO, and FSS fleets worked much as could be expected. A problem of primary impact early in the operation was the difficulty in activating RRF ships on time. If all elements of the sealift fleet had responded as planned, how much faster would the Phase I buildup have progressed? Figure 14 indicates how the closure of units might have been improved, assuming all RRF and FSS ships operated at their potential. Specifically, the following assumptions underlie the figure:

- All RRF and FSS activations are completed by their target date or the actual date that they achieved, whichever is earlier.

- Except for transits from the west coast to Gulf of Mexico or east coast ports, the transit time to the SPOE is three days or the actual transit time, whichever is smaller; for the FSS, it is two days or the actual transit time, whichever is smaller. The actual transit times were used for the seven west coast RRF RO/ROs which loaded in Gulf of Mexico or east coast SPOEs.
- Maximum loading times are three days for an RRF RO/RO or FSS, five days for an RRF breakbulk or other dry-cargo ship.
- Transit times are based on each ship's notional speed, with 1.5 days allowed for Suez Canal transits.
- Unloading times are the same as loading times.

It should be emphasized that, in developing the potential case, no new scheduling was done. Although ships activated sooner may have been able to make additional deliveries and thereby improve unit closures, only those deliveries that were actually scheduled are factored into the development of the potential performance. Further improvements over that indicated in the figure may thus be possible.

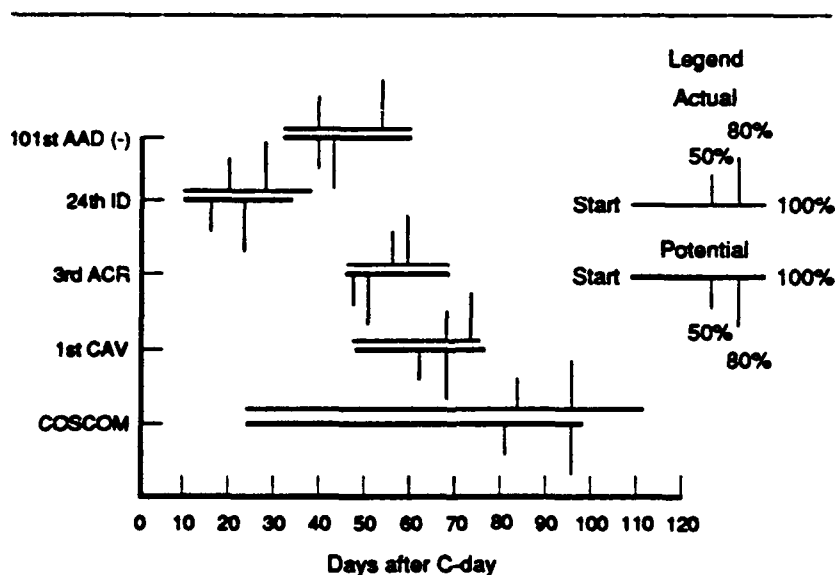


Figure 14. Potential Phase I unit and support equipment deliveries, by sealift time

Under these assumptions, more cargo would start arriving at about C+21. Noticeable improvements can be seen for the 101st Air Assault Division and the 3rd Armored Cavalry Regiment, with smaller differences in the other units. All COSCOM equipment would close about 10 days earlier. Keep in mind that this result does not assume that the schedule of RRF activation orders was speeded up. It assumes only that the RRF and FSS responded on time when called. Further improvements might be achieved by calling up more ships earlier.

ISSUE: COULD THE RRF SUBSTITUTE FOR FOREIGN CHARTERS?

Traditionally, military planners have been reluctant to rely on charters to meet sealift requirements. In Desert Shield/Storm, major use was made of charters, particularly foreign-flag ships. But what if those foreign charters had not been available? The circumstances of such an occurrence are not clear, but its implications for Desert Shield/Storm or a similar operation can be examined. Column 1 of table 11 shows the cumulative number of deliveries that chartered ships of foreign flag made at various times during the operation. Through C+195, 172 such shiploads were delivered to the seaports of debarkation (SPODs). Column 2 shows the cumulative number of deliveries made by RRF. Column 3 gives the total for both foreign charters and the RRF.

Table 11. Cumulative number of deliveries: actual RRF plus foreign charters compared to maximum possible RRF capability

	Foreign charters	Actual RRF	Foreign charters plus RRF	Theoretical RRF capability
C+30	0	0	0	0
C+40	0	4	4	16
C+60	11	23	34	75
C+90	38	38	76	75
C+120	46	49	95	150
C+150	78	74	152	166
C+180	158	102	260	225
C+195	172	112	284	225

Could the RRF generate 95 deliveries by C+120, or 284 by C+195? The last column shows an estimated RRF delivery schedule that uses the following assumptions:

- All 75 RRF breakbulk, RO/RO, LASH, and SEABEE ships are called up on C+3. At that time, 16 RO/ROs, 30 breakbulks, and 7 LASH/SEABEEs are in 5-day status, 21 breakbulks are in 10-day status, and one RO/RO is in 20-day status. (This readiness schedule is that which existed as Desert Shield began.)
- All activations occur on time in accordance with the ship readiness status.
- Ships take six days to transit to the SPOE. (This is the actual average experienced by RRF ships in Desert Shield/Storm. It includes some transits from the west coast to Gulf of Mexico ports.)
- RO/ROs load/unload in three days; all others in five.
- Transit to the debarkation port takes 23 days. (At advertised speeds, most RRF ships take from 21 to 26 days to transit to Saudi Arabia, depending on the SPOE.)

Figure 15 shows this same information for the entire period.

Clearly, under these assumptions, the RRF fleet could have met a delivery schedule similar to that which both foreign charters and the RRF achieved in Phase I of Desert Shield (deliveries until C+120). Also, since RRF ships carried about 25,000 more square feet of cargo per delivery than foreign charter ships, total cargo capacity would actually be greater. Thus, for operations of the same general size and rate of buildup as Phase I, the size of the RRF would appear to be about right. Of course, if the rate of buildup had been significantly greater, as it was in Phase II, the RRF could not have filled the shortfall.

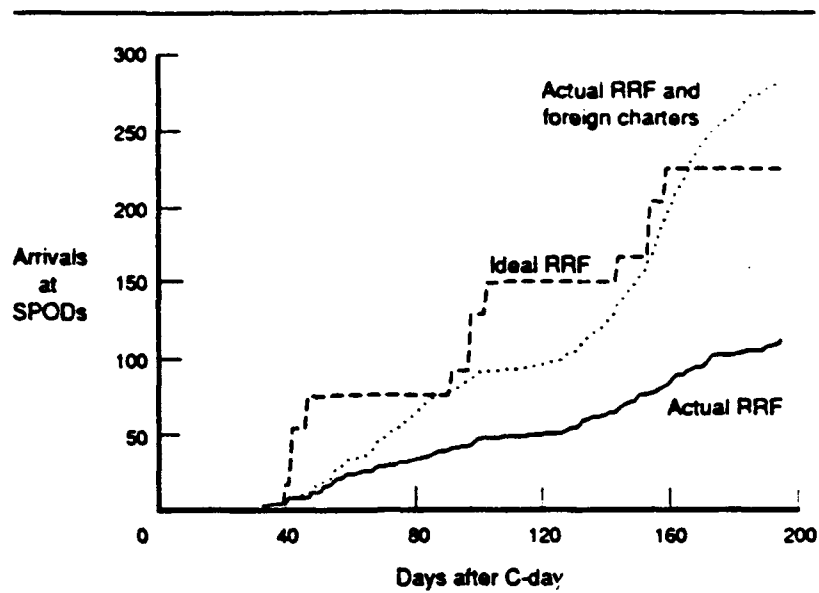


Figure 15. Number of deliveries made by ideally functioning RRF compared to actual RRF plus foreign charters

REFERENCES

- [1] CNA Research Memorandum 91-14, *Sealift Activity in Operation Desert Shield: 7 August 1990 to 9 January 1991* (U), Secret, Jan 1991
- [2] Office of the Secretary of Defense, *Logistics Support in the Vietnam Era*, Transportation and Movement Control Monograph 18, A report by the Joint Logistics Review Board, 1970
- [3] Commander-In-Chief, U.S. Pacific Fleet, *Korean War, U.S. Pacific Fleet Operations, Vol. III (Interim Evaluation Report No. 2: Logistics, 16 Nov 1950 to 30 Apr 1952)*, Undated
- [4] Military Traffic Management Command, Deployment Reports of 2 January 1991 and 5 January 1991, Secret

APPENDIX A

**CONVERSION FACTORS BETWEEN SQUARE FEET
AND SHORT TONS**

APPENDIX A

**CONVERSION FACTORS BETWEEN SQUARE FEET
AND SHORT TONS**

Sealift asset	Square feet per ton ^a
MPS	11.87
PREPO	10.09
FSS	19.33
RRF	11.69
Charter	
U.S.	13.92
Foreign	13.38

a. Based on Military Sealift Command, *Cargo Short Ton/ Passenger Lift Summary Report—Operation Desert Shield* (U)—as of 31 Dec 1990, Secret.

APPENDIX B
DETAILED DATA ON SHIP ACTIVATIONS
AND CARGO DELIVERIES

APPENDIX B

DETAILED DATA ON SHIP ACTIVATIONS AND CARGO DELIVERIES

The tables in this appendix provide detailed information about ship activations and deliveries of unit equipment and related support cargos. A glossary of the abbreviations used in the tables is on page B-21. The figures and tables presented in the main body are based on this information. There are three principal sources for the data. The Maritime Administration is responsible for the peacetime maintenance of RRF ships and is the source for data on the composition of the RRF and characteristics of RRF ships, such as age and type of propulsion. The Military Traffic Management Command (MTMC) is responsible for moving cargos from their points of origination to load ports. Also, MTMC must arrange for ships to be loaded. MTMC provided data on the load each ship carried and the unit associated with that load. MSC scheduled the various sealift assets and provided information on the stages of each ship's timeline, beginning with the time each ship was requested and continuing with transits to SPOEs and SPODs.

Table B-1 shows the RRF activation process. Ships are listed in chronological order based on the date activation was ordered by MSC. A total of 70 ships were ordered to activate in support of Desert Shield. The table lists 71 activations because one ship, *Delmonte*, failed to activate in her first attempt and a second activation attempt was ordered, with a successful activation, during Phase II. Two RRF ships, *Flickertail State* and *Gopher State*, were originally activated for another mission but were later made available for Desert Shield deliveries. These ships are not included in the table on RRF activations but are included in a later table listing cargo deliveries made by RRF ships. For each ship, table B-1 lists the physical characteristics—ship type, RRF readiness status, age, and type of propulsion (S = steam, D = diesel, G = gas turbine). The activation performance is indicated by the dates that activations were ordered and completed. Activation performance can be assessed by comparing this time interval with the RRF readiness status of the ship.

Table B-2 shows the FSS activation process. The fleet of Fast Sealift Ships comprises eight SL-7s. These ships are maintained in a reduced operating status designed to allow the ships to be ready to sail four days after receipt of an activation order. The table indicates the activation site and the dates activations were ordered and completed for each ship. It should be noted that *Denebola* was in a maintenance

overhaul when ordered to activate. Because this was a scheduled event, *Denebola* is treated in the report as having activated on time.

The remaining tables in the appendix present data showing the cargo deliveries made by ships in each of the various sealift fleets. Separate tables are presented in the following order: RRF, FSS, MPS, PREPO, U.S. charters, and foreign charters. These tables have similar formats. Each ship is characterized by the ship type, the notional square foot capacity, and the notional speed of advance. These factors directly affect a ship's delivery capability. MSC provided the data on ship capacities, and these figures include a stowage factor.

The other columns in the tables present the principal stages in the delivery process—the date MSC took operational control of a ship, the arrival and departure times at the SPOE, and finally, the arrival time at the SPOD. For RRF and FSS ships, MSC takes operational control when activations are completed (see tables B-1 and B-2). For the other ships, the date MSC took operational control is presented in the appropriate table. For MPS and PREPO ships, MSC took operational control when deployment orders were issued. For the chartered ships, the date MSC fixed a contract is presented. (For certain charters, the no-cost and space charters, MSC never assumed operational control of the ships.) Each ship transit is then described from the arrival and loading at the specified SPOE to the arrival at the SPOD. If a ship made multiple deliveries, each SPOE and SPOD is represented along with the ship timeline. For each delivery, the load carried, in thousands of square feet, and the unit supported are reported. Some deliveries were ongoing when this table was compiled; as a result, certain table entries are blank, pending completion of the delivery.

If a ship arrived in a SPOE on or before day C+92, the cargo it carried is included in the Phase I buildup. Ships arriving in SPOEs after day C+92 are assumed to support the Phase II buildup.

Table B-1. RRF ship activations

A	B	C	D	E	F	G	H
SHIPNAME	TYPE	RRF	YRS.	P	ACTIV.	ACTIVATION	ACTIVATION
		STATUS	OLD		SITE	ORDERED	COMPLETED
CAPE HENRY	RO/RO	5	11	D	NORF	3	8
CAPE HUDSON	RO/RO	5	11	D	NORF	3	8
CAPE INSCRIPTION	RO/RO	5	14	S	MOBILE	3	8
CAPE DOMINGO	RO/RO	5	17	D	NORF	3	10
CAPE LOBOS	RO/RO	5	18	D	NORF	3	11
CAPE HORN	RO/RO	5	11	D	OAKLAND	3	13
JUPITER	RO/RO	5	14	S	TACOMA	3	13
CAPE ISABEL	RO/RO	5	14	S	PORTLAND	3	14
CAPE DOUGLAS	RO/RO	5	17	D	JAX	3	17
CAPE DUCATO	RO/RO	5	18	D	LA	3	17
CAPE EDMONT	RO/RO	5	19	D	PORTLAND	3	17
COMET	RO/RO	5	32	S	PORTLAND	3	18
METEOR	RO/RO	5	23	S	LA	3	18
ADM. CALLAGHAN	RO/RO	20	23	G	NORF	3	19
CAPE DECISION	RO/RO	5	17	D	BALTIMORE	3	22
CAPE ALEXANDER	BB	5	28	S	NORF	3	24
CAPE LAMBERT	RO/RO	5	17	D	NORF	3	63
CAPE DIAMOND	RO/RO	5	18	D	NORF	3	134
CAPE FAREWELL	LASH	5	17	S	MOBILE	8	12
CAPE FLATTERY	LASH	5	17	S	MOBILE	8	13
CAPE MOHICAN	SEABEE	5	17	S	NORF	8	15
CAPE MAY	SEABEE	5	18	S	MOBILE	8	16
CAPE FLORIDA	LASH	5	19	S	MOBILE	8	72
CAPE CLEAR	BB	10	27	S	BEAU	11	17
GULF BANKER	BB	10	26	S	BEAU	11	18
CAPE JUBY	BB	5	28	S	NORF	11	21
CAPE CATOCHE	BB	5	27	S	PROV	11	22
CAPE JOHNSON	BB	5	28	S	NORF	11	35
CAPE BORDA	BB	5	23	S	SANFR	12	19
CAPE BRETON	BB	5	23	S	SANFR	12	19
WASHINGTON	BB/VEH	10	46	S	BEAU	12	23
EQUALITY STATE	T-ACS	5	29	S	NORLEANS	12	24
GULF TRADER	BB	5	26	S	BEAU	12	25
CAPE ARCHWAY	BB	5	27	S	BALTIMORE	12	27
CORNHUSKER STATE	T-ACS	5	21	S	NORF	12	32
CAPE NOME	BB	5	21	S	NORF	12	37
DEL VALLE	BB	10	22	S	BEAU	12	38
DELMONTE	BB	5	22	S	BEAU	12	CANX
CAPE MENDOCINO	SEABEE	5	18	S	NORLEANS	22	27
MAINE	BB/VEH	10	46	S	BEAU	22	36
AMERICAN OSPREY	TANKER	10	32	S	BEAU	23	34
AUSTRAL LIGHTNING	LASH	5	19	S	SANFR	45	50
CAPE GIBSON	BB	5	22	S	SUISAN BAY	45	50
CAPE GIPARDEAU	BB	5	22	S	SUISAN BAY	45	50

Table B-1. (Continued)

A	B	C	D	E	F	G	H
DELMONTE						94	103
CAPE ANN	BB	5	28 S	QUONSET		94	CANX
CAPE BOVER	BB	5	23 S	SANFR		119	123
CAPE BLANCO	BB	5	24 S	TACOMA		119	124
CALIFORNIA	BB	5	28 S	ALAMEDA		119	125
CAPE BON	BB	5	23 S	SANFR		119	125
NORTHERN LIGHT	BB	5	29 S	PORTLAND		119	125
CAPE CHARLES	BB	10	27 S	BEAU		119	126
DIAMOND STATE	T-ACS	5	28 S	NORLEANS		119	129
CAPE CARTHAGE	BB	5	27 S	MELVILLE		119	130
SANTA ANA	BB	10	27 S	BEAU		119	156
CAPE CATAWBA	BB	10	30 S	BEAU		119	134
CAPE COD	BB	10	27 S	BEAU		119	135
CAPE CANSO	BB	5	27 S	JAX		119	139
LAKE	BB	5	29 S	PHIL		119	169
PRIDE	BB	5	30 S	PHIL		119	161
SCAN	BB	5	29 S	PHIL		119	CANX
BANNER	BB	10	29 S	NORV		119	168
COURIER	BB	10	28 S	NORV		119	155
POTOMAC	TANKER	5	33 S	BEAU		122	135
AGENT	BB	5	29 S	NOKVA		122	154
CAPE ALAVA	BB	10	28 S	NY		122	157
CAPE AVINOF	BB	5	27 S	PORTLAND		122	175
BUYER	BB	5	28 S	MOBILE		171	178
CAPE CANAVERAL	BB	5	26 S	BALTIMORE		171	179
AMBASSADOR	BB	10	30 S	NORFOLK		162	171
AIDE	BB	10	30 S	CHARLESTON		171	CANX
MISSION BUENAVENTURA	TANKER	5	22 S	JAX		182	

Table B-2. FSS activations

A	B	C	D	E	F
SHIPNAME	TYPE	ROS	ACTIV.	ACTIVATION	ACTIVATION
		STATUS	SITE	ORDERED	COMPLETED
CAPELLA	SL-7	4	JAX	0	2
ALTAIR	SL-7	4	NORFOLK	0	3
REGULUS	SL-7	4	VIOLET, LA	0	5
POLLUX	SL-7	4	VIOLET, LA	1	4
BELLATRIX	SL-7	4	GALVESTON	1	3
ALGOL	SL-7	4	GALVESTON	1	5
DENEBOA	SL-7	4	BAYONNE	1	10
ANTARES	SL-7	4	JAX	1	8

Table B-3. RRF cargo deliveries

A	B	C	D	E	F	G	H	I	J	K
SHIPNAME	TYPE	CAPACITY (KSOFT)	SPEED	SPOE	ARRIVAL	DEPARTURE	SPOD	ARRIVAL	LOAD (KSOFT)	UNIT
CAPE HENRY	RO/RO	139	20	WILMINGTON JAX	10 56		13 AD DAIAMAM 59 AD DAIAMAM	33 83	130 155	1ST COSCOM 1ST COSCOM
				ROTTERDAM	102		114 AD DAIAMAM	129	107	2ND COSCOM
CAPE HUDSON	RO/RO	139	18	HOUSTON SAVANNAH	158 12		166 AD DAIAMAM 15 AD DAIAMAM	195 36	170	CSS 197 INF
				HOUSTON	60		63 AD DAIAMAM	88	168	13TH COSCOM
				NORDENHAM	108		109 AD DAIAMAM	128	114	2 ACR/POMCUS
CAPE INSCRIPTION	RO/RO	115	20	BREMERHAVEN SAVANNAH	148 11		156 AD DAIAMAM 13 AD DAIAMAM	173 32	120	GERMAN HETTS 197 INF
				HOUSTON	87		59 AD DAIAMAM	81	108	13TH COSCOM
				NORDENHAM	106		108 AD DAIAMAM	121	80	2 ACR
CAPE DOMINGO	RO/RO	115	18	BREMERHAVEN BAYONNE	139 181		143 AD DAIAMAM 186 AD DAIAMAM	159 203	94	1ST ARMORED CSS
				SUNNY POINT	10		18 AD DAIAMAM	41	125	4TH MEB
				ROTTERDAM	108		112 AD DAIAMAM	130	99	2ND COSCOM
CAPE LOBOS	RO/RO	62	17	CHARLESTON JAX	155 12		157 AD DAIAMAM 14 AD DAIAMAM	183 40	133	CSS 101ST
				BAYONNE	71		73 AD DAIAMAM	99	57	1ST COSCOM
				BREMERHAVEN	124		128 AD DAIAMAM	150	49	1ST ARMORED
CAPE HORN	RO/RO	139	18	BAYONNE	180		182 AD DAIAMAM	55	53	HEMTS
				BEAUMONT	25		29 AD DAIAMAM	55	167	3RD ACR
				BAYONNE	83		84 AD DAIAMAM	108	70	1ST COSCOM
				ANTWERP	129		133 AD DAIAMAM	150	177	3RD ARMORED
JUPITER	RO/RO	115	20	JAX	178		193 AD DAIAMAM	52	187	CS/CSS
				HOUSTON	27		29 AD DAIAMAM	102	59	13TH COSCOM
				BREMERHAVEN	79		88 AD DAIAMAM	150	115	
				JAX	124		131 AD DAIAMAM	150	87	CSS
CAPE ISABEL	RO/RO	115	20	JAX	174		177 AD DAIAMAM	102	102	CSS
				WILMINGTON	27		31 AD DAIAMAM	52	77	1ST COSCOM
				CHARLESTON	69		74 AD DAIAMAM	95	93	1ST COSCOM
				BREMERHAVEN	115		119 AD DAIAMAM	133	110	VII CORPS
				BREMERHAVEN	166		167 AD DAIAMAM	181	63	GERMAN EQUIP
CAPE DOUGLAS	RO/RO	115	18	JAX	17		18 AD DAIAMAM	41	184	101ST
				ROTA	57		62 AD DAIAMAM	78	100	212TH FA BDE
				BREMERHAVEN	103		114 AD DAIAMAM	133	102	2 ACR
				BAYONNE	169		171 AD DAIAMAM	195	112	CSS

Table B-3. (Continued)

A	B	C	D	E	F	G	H	I	J	K
CAPE DUCATO	RORO	115	18	BEAUMONT	30	31	AD DAMMAM	58	113	3RD ACR
				BREMERHAVEN	77	60	AD DAMMAM	99	115	
				POTTERDAM	122	126	AD DAMMAM	148	108	3RD ARMORED
CAPE EDMONT	RORO	112	18	BREMERHAVEN	185	187	AD DAMMAM		144	GERMAN EQUIP
				HOUSTON	31	33	AD DAMMAM	84	116	57 SIG BDE
				NORFOLKHAM	110	111	AD DAMMAM	127	102	2 ACR
				NAHA	145	149	AD DAMMAM	185	79	III MEF
				BREMERHAVEN	185	194				GERMAN EQUIP
CONNET	RORO	65	18	BEAUMONT	36	44	AD DAMMAM	68	63	1ST BDE 2 AD
				JAX	100	112	AD DAMMAM	138	55	1ST COSCOM
				JAX	178	184	AD DAMMAM		57	CSS
METEOR	RORO	75	18	BEAUMONT	31	34	AD DAMMAM	59	71	1ST COSCOM
				BREMERHAVEN	114	116	AD DAMMAM	133	57	VII CORPS
ADM CALLAGHAN	RORO			HOUSTON	180	184	AD DAMMAM	193	71	CSS
CAPE DECISION	RORO	128	20	JAX	20	22	AD DAMMAM	41	114	101ST
		115	18	WILMINGTON	22	25	AD DAMMAM	48	133	18TH AIR
				BAYONE	75	79	AD DAMMAM	100	106	1ST COSCOM
				HOUSTON	129	132	AD DAMMAM		164	1ST ID
CAPE ALEXANDER	88	50	18	BAYONE	189	194	AD DAMMAM	55	43	101ST
CAPE LAMBERT	RORO	62	17	JAX	65	69	AD DAMMAM	98	47	1ST COSCOM
				BAYONE	128	134	AD DAMMAM		53	
				BAYONE	187	192	AD DAMMAM		53	RESUPPLY
CAPE DIAMOND	RORO	115	17	HOUSTON	139	142	AD DAMMAM	172	111	1ST ID
CAPE FAREWELL	LASH	117	18	WILMINGTON	17	34	AD DAMMAM	59	60	1ST COSCOM
				LIVORNO	117	127	AD DAMMAM	145	25	AMM/78 M1A1
CAPE FLATTERY	LASH	117	18	NORFOLKHAM	194	196	AD DAMMAM		30	ARMY/AF EQ
				WILMINGTON	17	35	AD DAMMAM	58	55	1ST COSCOM
CAPE MORGAN	SEABEE	78	18	SUNNY POINT	114	133	AD DAMMAM	162	155	AMMO
				JAX	15	25	AD DAMMAM	48	65	101ST
				BREMERHAVEN	73	78	AD DAMMAM	DW		
CAPE MAY	SEABEE	78	18	BREMERHAVEN	157	181	AD DAMMAM	184	86	GERMAN EQUIP
				WILMINGTON	18	24	AD DAMMAM	48	80	1ST COSCOM
CAPE FLORIDA	LASH	100	18	ANTWERP	139		AD DAMMAM			
CAPE CLEAR	88	31	18	SUNNY POINT	73	123	AD DAMMAM	180	130	AMMO
				HOUSTON	18	25	AD DAMMAM	61	35	III CORPS
				MOREHEAD CITY	118	124	AL JUBAYL	145	31	
				NORFOLKHAM	163	171	AL JUBAYL	190	25	SUST MUNITION
GULF BANKER	88	31	18	BEAUMONT	19	22	AD DAMMAM	DW		3RD ACR

Table B-3. (Continued)

A	B	C	D	E	F	G	H	I	J	K
				BEAUMONT	100	124	AD DAMMAM	161	28	214TH MED
				SUNNY POINT	180	187	ROTA	197	40	AMMO
CAPE JUBY	BB	60	18	JAX	24	28	AD DAMMAM	49	39	101ST
				NORRHAM	107	116	AD DAMMAM	132	20	AMMO
				GLAM	198		AL JUBAYL			AMMO USMACUSN
CAPE GATOCHE	BB	32	18	JAX	28	31	AD DAMMAM	64	16	101ST
				NORRHAM	81	99	AD DAMMAM	116	20	AMMO
				GLEN DOUGLAS	149	178	AL JUBAYL	196	60	AMMO USMC
CAPE JOHNSON	BB	30	20	JAX	57	63	AD DAMMAM	85	48	1ST COSCOM
				ROTTERDAM	108	122	AD DAMMAM	139	48	2ND COSCOM
				SUNNY POINT	187		RIHAM			AMMO
CAPE BORDA	BB	51	18	LONG BEACH	28	34	AL JUBAYL	79	41	1ST MEF
				MOREHEAD CITY	115	121	AL JUBAYL	141	51	II MEF
				LIVORNO	158	159	AD DAMMAM	171	45	PCARS
				GLAM	187	195	AD DAMMAM		36	AMMO USAF
CAPE BRETON	BB	51	17	CONCORD	22	38	AD DAMMAM	88	40	AMMO
				OAKLAND	105	111	AD DAMMAM	141	30	864 ENG
				EENSHAVEN	159	175	AD DAMMAM		30	AMMO
WASHINGTON	BB/VEH	40	18	HOUSTON	53	58	AD DAMMAM	DW	56	76TH FA BDE
				BREMENHAVEN	129	134	AD DAMMAM		55	1ST ARMORED
				LIVORNO	176		AD DAMMAM			
EQUALITY STATE	T-ACS	99	18	BAYONE	33	36	AD DAMMAM	DW	34	48/85 MED
				ROTTERDAM	102	119	AD DAMMAM	135	32	2ND COSCOM
GULF TRADER	BB	31	18	BEAUMONT	25	30	AD DAMMAM	56	43	3RD ACR
				BAYONE	119	122	AD DAMMAM	144	38	542
CAPE ARCHWAY	BB	30	18	SUNNY POINT	27	35	AD DAMMAM	63	40	AMMO
CORNHUSKER STATE	T-ACS	52	18	BAYONE	31	34	AD DAMMAM	52	48	CS/CSS
				NORRHAM	134	139	AD DAMMAM	157	50	1ST ARMORED
CAPE NOME	BB	34	20	CHARLESTON	39	44	AD DAMMAM	89	55	1ST COSCOM
				ROTTERDAM	98	117	AD DAMMAM	132	47	2ND COSCOM
				SUNNY POINT	178	182	AD DAMMAM		55	AMMO
DEL VALLE	BB	30	18	JAX	42	48	AD DAMMAM	76	53	1ST COSCOM
				WILMINGTON	130	133	AL JUBAYL	156	40	II MEF
DELMONTE	BB	30	18	BEAUMONT	126	131	AD DAMMAM		34	CS
				BEAUMONT	126	131	AD DAMMAM		34	XFER TO PONCE
CAPE MENDOCINO	SEABEE	78	18	HOUSTON	29	32	AD DAMMAM	DW	66	212 FA BDE
				BREMENHAVEN	72	79	AD DAMMAM	100	78	
				BREMENHAVEN	124	131	AD DAMMAM	151	65	1ST ARMORED
MAINE	SEATRAN	51	18	HOUSTON	37	49	AD DAMMAM	72	53	1ST CAV

Table B-3. (Continued)

A	B	C	D	E	F	G	H	I	J	K
				ROTTERDAM	128	128	AD DAMMAM	147	52	3RD ARMORED
				LIVORNO	173	181	AD DAMMAM	198	86	M109/110
AMERICAN OSPREY	TANKER		18	HOUSTON	45	48	AD DAMMAM	92		FUEL
AUSTRAL LIGHTNING	LASH	100	18	OAKLAND	59	62	AD DAMMAM	87	109	1ST COSCOM
				OAKLAND	132	135	AD DAMMAM	182	109	USAF AMMO
				LIVORNO	189					
CAPE GIBSON	BB	55	18	OAKLAND	52	63	AD DAMMAM	88	45	52 ENG
				NORFOLK	115	12	AD DAMMAM	144	20	AMMO
				GUAM	188	178	JIDDAH	191	50	AMMO USAF
CAPE GIRARDEAU	BB	75	18	PORT HUENEME	64	72	GUAM	91	75	NACB
				PORT HUENEME	124	138	AD DAMMAM	165	40	5TH MEB AFOE
CAPE BOVER	BB	54	18	OAKLAND	129	137	AD DAMMAM	187	44	CSS
CAPE BLANCO	BB	33	18	OAKLAND	132	137	AD DAMMAM	188	34	CSS
CALIFORNIA	BB	57	18	OAKLAND	125	131	AD DAMMAM	173	29	1742 TC CO
CAPE BON	BB	47	18	OAKLAND	131	137	AD DAMMAM	174	33	250 TC CO
				NORFOLK	198					AMMO ARMY
NORTHERN LIGHT	BB	49	18	OAKLAND	130	137	AD DAMMAM	173	23	CSS
				RAYSUT	181	197	AD DAMMAM	190	10	AMMO
CAPE CHARLES	BB	42	18	WILMINGTON	132	137	AL JUBAYL	161	36	II MEF
DIAMOND STATE	T-ACS	40	20	CHARLESTON	133	137	AD DAMMAM	187	41	CSS
CAPE CARITHAGE	BB	43	18	BAYONNE	131	138	AD DAMMAM	181	34	CSS
				AUSTERDAM	181		AD DAMMAM			AMMO ARMY
CAPE CATAWBA	BB	41	18	BEAUMONT	134	139	AD DAMMAM	171	41	CSS
				TENGAH	194		AD DAMMAM			AMMO USAF
CAPE COO	BB	42	18	JAX	138	142	AD DAMMAM	168	33	CSS
CAPE CANSO	BB	42	18	CHARLESTON	139	143	AD DAMMAM	172	31	CSS
POTOMAC	TANKER			HOUSTON			AD DAMMAM			RTN TO MARAD
FLICKERTAIL STATE	T-ACS	47	18	PORT HUENEME	111	132	AD DAMMAM	181	35	5TH MEB AFOE
GOPHER STATE	T-ACS	42	18	OAKLAND	108	119	AD DAMMAM	148	25	BRADLEYS
BANNER	BB	58	18	JAX	189	186	AD DAMMAM		39	CSS
PRICE	BB	40	17	EARLE	173	187	AL JUBAYL		32	AMMO USMC
LAKE	BB			JAX	178	185	AD DAMMAM		35	AMMO
COURIER	BB	56	18	SUNNY POINT	160	171	AD DAMMAM	201	45	AMMO USMC
SANTA ANA	BB	57	18	JAX	156					RTN TO MARAD
BUYER	BB	55	17	SUNNY POINT	186	195	ROTA		45	AMMO
AMBASSADOR	BB	50	18	CHEATHAM	189	198	AD DAMMAM		20	AM-2 MATTING

Table B-4. FSS cargo deliveries

A	B	C	D	E	F	G	H	I	J	K
SHIPNAME	TYPE	CAPACITY (KSGFT)	SPED	SPOE	ARRIVAL	DEPARTURE	SPOD	ARRIVAL	LOAD (KSOFT)	UNIT
CAPELLA	SL-7	150	30	SAVANNAH	3		AD DAMMAM	20	130	24TH ID
				HOUSTON	39	42	AD DAMMAM	60	152	1ST CAV
				BAYONNE	78	83	AD DAMMAM	99	130	1ST COSCOM
				BREMERHAVEN	115	119	AD DAMMAM	130	152	VII CORPS
				JAX	165	170	AD DAMMAM	190	156	CSS
ALTAIR	SL-7	150	30	SAVANNAH	4	7	AD DAMMAM	21	109	24TH ID
				ROTA	33	38	AD DAMMAM	47	117	24TH ID
				HOUSTON	67	70	AD DAMMAM	88	148	13TH COSCOM
				HOUSTON	107	121	AD DAMMAM	137	149	CS
				POTTERDAM	154	157	AD DAMMAM	168	139	3RD ARMORED
REGALIS	SL-7	150	30	SAVANNAH	7	9	AD DAMMAM	24	107	24TH ID
				BEAU	43	47	AD DAMMAM	63	166	1ST BDE 2ND AD
				JAX	83	87	AD DAMMAM	101	140	1ST COSCOM
				BREMERHAVEN	116	121	AD DAMMAM	132	153	VII CORPS
				BREMERHAVEN	148	150	AD DAMMAM	163	161	ARMOR
				JAX	181					
POLLUX	SL-7	150	30	WILMINGTON	6	9	AD DAMMAM	24	120	16TH AIR
				HOUSTON	43	48	AD DAMMAM	66	149	1ST CAV
				BAYONNE	88	89	AD DAMMAM	104	96	1ST COSCOM
				BREMERHAVEN	121	123	AD DAMMAM	135	138	1ST ARMORED
				JAX	153	157	AD DAMMAM	174	144	TRK CO'S
BELLATRIX	SL-7	150	30	SAVANNAH	5	8	AD DAMMAM	25	125	24TH ID
				HOUSTON	45	49	AD DAMMAM	67	167	1ST CAV
				HOUSTON	88	94	AD DAMMAM	112	150	13TH COSCOM
				BREMERHAVEN	133	137	AD DAMMAM	150	153	1ST ARMORED
				BAYONNE	171	181	AD DAMMAM	197	153	TANKS+HEMITS
ALGOL	SL-7	150	30	SAVANNAH	8	10	AD DAMMAM	29	161	24TH ID
				BEAUMONT	58	61	AD DAMMAM	78	158	11TH ADA BDE
				POTTERDAM	99	108	AD DAMMAM	120	140	VII CORPS
				HOUSTON	139	143	AD DAMMAM	161	115	1ST ID
DENEBOLA	SL-7	150	30	SAVANNAH	12	15	AD DAMMAM	31	129	197 INF
				HOUSTON	50	54	AD DAMMAM	71	157	1ST CAV
				HOUSTON	104	122	AD DAMMAM	140	157	1ST ID
				LONG BEACH	177	185	AL JUBAYL		164	MEF RESERVE
ANTARES	SL-7	150	30	SAVANNAH	9	12	AD DAMMAM	DIW	117	24TH ID

Table B-5. MPS cargo deliveries

A	B	C	D	E	F	G	H	I	J	K	L
SHIPNAME	TYPE	CAPACITY (KSGFT)	SPEED	DEPLOYMENT ORDER	SPOE	ARRIVAL	DEPARTURE	SPOD	ARRIVAL	LOAD (KSGFT)	UNIT
BONETMAN	MPS	125	15	0	DIEGO GARCIA	0		0 AL JUBAYL	8	187	7TH MEB
ANDERSON	MPS	125	15	0	JAX	46		52 AD DAMMAM	77	132	1ST COSCOM
					DIEGO GARCIA	0		0 AL JUBAYL	8	167	7TH MEB
					NEWPT NEWS	42		47 AD DAMMAM	80	115	85TH EVAC
BAUGH	MPS	125	15	0	ROTTERDAM	121		125 AD DAMMAM	144	95	3RD ARMORED
					BLOUNT ISLAND	0		5 AL JUBAYL	29	167	7TH MEB
					CHARLESTON	58		61 AD DAMMAM	88	120	1ST COSCOM
FISHER	MPS	125	15	0	DIEGO GARCIA	8		9 AL JUBAYL	16	167	7TH MEB
					HOUSTON	54		57 AD DAMMAM	86	119	13TH COSCOM
					ANTWERP	110		115 AD DAMMAM	134	110	2ND COSCOM
					BAYONNE	163		168 AD DAMMAM	194	108	CSS
HALGE	MPS	125	15	0	DIEGO GARCIA	0		0 AL JUBAYL	8	167	7TH MEB
					CHARLESTON	47		50 AD DAMMAM	75	101	1ST COSCOM
					BREMERHAVEN	98		113 AD DAMMAM	134	86	2 ACR
					JAX	164		169 AD DAMMAM	193	112	CSC
LLAMIS	MPS	170	15	0	GUAM	0		0 AL JUBAYL	18	226	1ST MEB
LOPEZ	MPS	170	15	0	GUAM	0		0 AL JUBAYL	18	226	1ST MEB
					JAX	69		77 AD DAMMAM	111	112	1ST COSCOM
					ROTTERDAM	133		138 AD DAMMAM	166	162	3RD ARMORED
BUTTON	MPS	170	15	0	GUAM	4		4 AL JUBAYL	24	226	1ST MEB
WILLIAMS	MPS	170	15	0	GUAM	0		0 AL JUBAYL	18	226	1ST MEB
KOCAK	MPS	170	15	100	MOREHEAD CITY	0		100 AL JUBAYL	128	226	6TH MEB
OREGON	MPS	170	15	100	MOREHEAD CITY	0		100 AL JUBAYL	128	226	6TH MEB
PLESS	MPS	170	15	100	MOREHEAD CITY	0		100 AL JUBAYL	128	226	6TH MEB
					ANTWERP	157		160 AD DAMMAM	177	158	VII CORPS
BOBO	MPS	170	15	100	MOREHEAD CITY	0		100 AL JUBAYL	128	226	6TH MEB

Table B-4. PREPO cargo deliveries

A	B	C	D	E	F	G	H	I	J	K	L
SHIPNAME	TYPE	CAPACITY (KSOFT)	SPEED	DEPLOYMENT ORDER	SPOE	ARRIVAL	DEPARTURE	SPOD	ARRIVAL	LOAD (KSOFT)	UNIT
SANTA VICTORIA	BB	60	18	2	DIEGO GARCIA	0	2	AD DAMMAM	11	50	PREPO
GREENHARBOR	LASH	100	18	2	DIEGO GARCIA	0	0	AD DAMMAM	10	100	PREPO
					SUNNY POINT	58	62	AD DAMMAM	68	95	AMMO
					LIVORNO	149	177	AD DAMMAM	192	45	AMMO
GREEN ISLAND	LASH	117	18	2	DIEGO GARCIA	0	2	AD DAMMAM	10	117	PREPO
					SUNNY POINT		123	AD DAMMAM	152	120	AMMO
AUSTRAL RAINBOW	SEABEE	100	20	2	DIEGO GARCIA	85	2	AD DAMMAM	10	100	PREPO
					LONG BEACH	0	84	RAVSUT	112	78	4449 MOB
					LIVORNO	60	146				AMMO
					SUNNY POINT	195					AMMO
ADVANTAGE	BB	60	18	2	MED	143	2	JIDDAH	13	60	PREPO
					ROTTERDAM	123	128	AD DAMMAM	147	74	340 ARMORED
					NORFOLK	170	182	AD DAMMAM		50	SUST MAINTION
AMERICAN CORMORANT	BB	40	18	2	DIEGO GARCIA	123	2	AD DAMMAM	11	40	PREPO
					NORFOLK	166	173	AD DAMMAM		55	AMMO-LCLUS
NOBLE STAR	BB	85	18	2	DIEGO GARCIA	0	2	AL JUBAYL	14	85	PREPO
					LIVORNO	0	38	AD DAMMAM	52	5	12TH AVN BDE
					WILMINGTON	33	122	AL JUBAYL	147	93	II MEF
					SUNNY POINT	183	188	AD DAMMAM		90	AMMO(CTN)
AMERICAN KESTRAL	LASH	115	18	2	DIEGO GARCIA	114	2	DUBAI	14	115	PREPO
					SUNNY POINT	102	147	AD DAMMAM	181	115	AMMO

Table B-7. Cargo deliveries by U.S. charters

A	B	C	D	E	F	G	H	I	J	K	L
CHARTER SHIP	TYPE	CAPACITY (kcsqft)	SPEED	CONTRACT (C+)	SPOE	ARRIVE	DEPART	SPOD	ARRIVE	LOAD (kcsqft)	UNIT
AMERICAN EAGLE	RO/RO	80	18	0	JAX	9	12	AD DAMMAM	33	90	101ST
					JAX	58	60	AD DAMMAM	81	93	1ST COSCOM
MAERSK CONST.	RO/RO	80	17	0	HOLSTON	112	120	AD DAMMAM	153	88	1ST ID
					GUAM	18	26	AL JUBAYL	42	48	NMCB 40
ROVER	BB	80	20	0	BREMER-HAVEN	150	155	AD DAMMAM	174	88	POMCUS
					SUNNY POINT	27	43	AD DAMMAM	85	40	AMMO
					SUBIC	144	153	AD DAMMAM	188	40	AMMO
MERCURY	RO/RO	111	20	0	HOLSTON	34	38	AD DAMMAM	58	118	57TH SIG BDE
					ANTWERP	98	112	AD DAMMAM	126	91	2ND COSCOM
					JAX	173	175	AL JUBAYL	198	42	USAC
GREENRIDGE	BB	80	17	0	PORT-LENEVE	28	30	AD DAMMAM	61	37	NMCB 5
					LONG BEACH	98	108	AL JUBAYL	144	28	3RD MAW
GREENWAVE	BB	80	17	0	RICHAM	183	188	AD DAMMAM		60	AMMO USAF
LYRA	RO/RO	80	18	3	NORDENHAM	50	57	AD DAMMAM	76	60	AMMO
					JAX	18	18	AD DAMMAM	41	99	101ST
					JAX	67	69	AD DAMMAM	95	74	1ST CC
					ANTWERP	118	124	AD DAMMAM	142	91	AMMO
					LIVORNO	158	161	AD DAMMAM	175	105	POMCUS
					LIVORNO	191					
CLEVELAND	BB	85	18	4	SUNNY POINT	9	24	AD DAMMAM	45	75	AMMO
					ANTWERP	113	117	AD DAMMAM	132	72	2ND CC
					SASEBO	147	171	AL JUBAYL	186	70	AMMO USMCUSAF
TAMPA BAY	BB	50	18	4	WILMINGTON	18	24	AD DAMMAM	44	48	18TH AIR
					SUNNY POINT	79	94	AD DAMMAM	115	35	AMMO
					ROTTERDAM	138	143	AD DAMMAM	180	61	3RD ARMORED
STRONG TEXAN	HL	75	12	18	SUNNY POINT	19	22	AD DAMMAM	55	25	4TH MEB
					SOUTH HAMPTON	114	120	AD DAMMAM	148	75	
					LIVORNO	173	178	JIDDAH	185	18	USAF VEHICLES
ASHLEY LYKES	BB	52	18	21	BEALMONT	22	26	AL JUBAYL	49	52	3RD ACR
					ROTA	78	82	AD DAMMAM	95	52	
					ROTTERDAM	115	119	AD DAMMAM	137	47	2ND CC
AMERICAN CONDOR	RO/RO	80	18	22	JAX	44	46	AL JUBAYL	68	80	3RD ACR/75TH
					CHARLESTON	139	140	AD DAMMAM	182	47	CSS
AMERICAN FALCON	RO/RO	17		22	WILMINGTON	26	27	AD DAMMAM	51	56	197 SPT
					BREMER-HAVEN	98	108	AD DAMMAM	125	136	2 ACR/POMCUS
					BREMER-HAVEN	143	145	AD DAMMAM	181	136	2ND ARMORED

Table B-7. (Continued)

A	B	C	D	E	F	G	H	I	J	K	L
GREENLAKE	RORO	100	18	28	BREMERHAVEN TACOMA	198 40	43	AD DAMMAM	89		78 9TH ID
					JAX	114	118	AD DAMMAM	141		78 43RD ENG
ZOELLA LYLES	BB				LIVORNO	170	174	AD DAMMAM	188		77 40TH MOD
		52	18	35	BENJAMONT	37	41	AD DAMMAM	66		51 1 BLUE 2ND AD
					ROTTERDAM	93	112	AD DAMMAM	132		50 2ND CC
					SUNNY POINT	182	172	AD DAMMAM	197		35 ANMO USMC
MARINE RELIANCE	RORO	48	18	37	BAYONNE	38	42	AD DAMMAM	63		42 1ST CC
					WILMINGTON	121	126	AL JURAYL	151		70 II MEF
STRONG AMERICA	RORO	62	14	93	HOLSTON	125	128	AD DAMMAM	184		52 1ST INF
GALVESTON BAY	RORO	50	19	98	JAX	117	125	AD DAMMAM	146		53 II MEF
					LISBON	181	191	AD DAMMAM	204		50 ANMO ARMY
JOHN LYLES	BB	50	18	99	BEALMONT	124	128	AD DAMMAM	155		52 CS
					ROHAM	175		AD DAMMAM			ANMO
LASH ATLANTICO	LASH	62	17	102	BAYONNE	111	116	AD DAMMAM	138		61 656 TC/FORCE
					JAX	188	177	AL JURAYL	198		41 II MEF
JOSEPH LYLES	BB	50	18	113	ANTWERP	125	130	AD DAMMAM	146		47 2ND CC
LETITIA LYLES	BB	50	18	115	NEWS	123	128	AD DAMMAM	150		55 365 MD 1229
					CONCORD	182	196	JIDDDAH			45 ANMO USAF
NANCY LYLES	BB	60	18	115	ANTWERP	131	135	AD DAMMAM			61 1ST AIRMOB
					SUNNY POINT	183	189	AD DAMMAM			45 ANMO
SENATOR	RORO	52	17	118	JAX	129	131	AD DAMMAM			72 CSS
					LIVORNO	172	175	AD DAMMAM	189		72 HETS
RUTH LYLES	BB	50	19	119	ROTTERDAM	134	138	AD DAMMAM			49 3RD ARMORED
					SUNNY POINT	185	194	JIDDDAH			45 ANMO
MALLORY LYLES	BB	120	21	122	JAX	132	135	AD DAMMAM	158		102 II MEF CTNRS
PONCE	RORO	150	21	134	JAX	144	147	AD DAMMAM	168		135 CSS
LESLIE LYLES	BB	50	17	146	HOLSTON	157	159	AD DAMMAM	190		54 CSS

Table B-6. Cargo deliveries by foreign charters

CHARTER SHIP	FLAG	B	C	D	E	F	G	H	I	J	K	L	M
			TYPE	CAPACITY (RSOFT)	SPEED	CONTRACT (C+)	SPOE	ARRIVE	DEPART	SPOE	ARRIVE	LOAD (RSOFT)	UNIT
SUPER SERVANT III	DUTCH		SEMI SUB		18		4 LITTLE CREEK	11	22	BAIRAIN		55	MISC
SSB TIGS	PANAMA		P/O		14		8 JEXSTON	10	12	AD DAMMAM		44	
ASI CYGNUS	BAHAMAS		ROFO	60	18		14 SAVANNAH	17	19	AD DAMMAM		43	79 24TH CC
							BAVARE	73	74	AD DAMMAM		98	75 1ST CC
							NOTTERHAM	120	121	AD DAMMAM		141	87 3RD AIRMAVIL CORP
							JAY	160	173	AD DAMMAM		200	88 CCS
MERCHANT PREMIER	BRITAIN		BB	88	15		17 BEAU	39	43	AD DAMMAM		71	49 1ST BDE 2ND AD
SAUDI MAIL	ITALY		ROFO	132	18		CEFC	172	185	AL JIBAYL		55	AMAL LEAC
							17 JAX	31	34	AD DAMMAM		80	140 101ST
							ANTWERP	98	109	AD DAMMAM		128	130 2ND CC
							ROJTERHAM	150	160	AD DAMMAM		181	140 12854 ENG
MERZARIO ITALIA	ITALY		ROFO	75	16		17 JAX	51	53	AD DAMMAM		80	83 1ST CC
							JEXSTON	111	120	AD DAMMAM		150	712 158 AVN BN
							IMKHO	168	170	PERKY		174	52 IF PRVMENTO
							INCINO	178	195	AD DAMMAM		81	PM 116
AMVERDUALS	NORWAY		BB	45	17		17 IRALANT	31	32	AD DAMMAM		59	35 3RD ACH
OSLO (BASSO) POLAR	NORWAY		ROFO	45	14		17 SUNNY POINT	20	32	AD DAMMAM		60	71 4TH AB
							BRALANT	124	128	AD DAMMAM		156	52 CCS
							IMKHO	173	170	AD DAMMAM		196	89 AM 2
LA PAIX	PANAMA		BB	30	16		17 JEXSTON	19	22	AD DAMMAM		49	37 3RD COPIPS
ARCATE EAGLE	NORWAY		ROFO	42	16		21 NOTTERHAM	31	31	AD DAMMAM		56	42 2ND CC
							ANTWERP	141	143	AD DAMMAM		187	30 341 AIRME D
WADAI	ANTIGUA		BB	61	17		22 IMKHO	26	33	AD DAMMAM		48	10 12TH AVN BDE
JOLLY SMERALDO	ITALY		ROFO	73	17		22 INCINO	27	32	AD DAMMAM		49	10 12TH AVN BDE
							OAKLAND	80	87	AD DAMMAM		142	36 52ND FNG BN
							NOTTERHAM	144	147	AD DAMMAM		179	97 341 AIRME D
TAKORADI	PANAMA		ROFO	77	16		24 JEXSTON	28	30	AD DAMMAM		55	56 212TH FA BDE
SAUDI MAKKAH	SAUDI ARABIA		ROFO	100	18		24 JEXSTON	50	52	AD DAMMAM		76	104 1 CAV
							NOTTERHAM	98	110	AD DAMMAM		122	95 2ND CC
							BRALANT	144	146	AD DAMMAM		183	115 2ND AIRM DIV
							BAVARE	186	187	AD DAMMAM		93	93 CCS
SAUDI RIYADI	SAUDI ARABIA		ROFO	100	18		24 IRALANT	46	48	AD DAMMAM		73	108 1ST BDE 2ND AD
							NOTTERHAM	93	112	AD DAMMAM		125	88 2ND CC
							NOTTERHAM	146	149			186	115 12 AIRCVM
							JAX	192					
NEOS	CYPRUS		BB	40	14		25 WILMINGTON	30	33	AD DAMMAM		87	20 18TH AIR
							NOTTERHAM	158	167	AD DAMMAM		194	25 51ST MINTIONS
METRO NEW N DUNE	DENMARK		ROFO	38	15		25 CHARLESTON	40	42	AD DAMMAM		73	34 1ST CC
MEHMAN SENATOR	DENMARK		ROFO	38	14		25 CHARLESTON	38	39	AD DAMMAM		73	34 1ST CC
ALPHA CHALLENGE	OFFICE		BB	55	14		25 UNANTHEAD	38	42	AL JIBAYL		78	28 1ST MEF
MAXSTAR	NORWAY		BB	55	15		25 HIEF	40	47	AL JIBAYL		81	49 11TH SIG BDE
							SUNNY POINT	186	195	HIFHAM		205	45 AMMO

Table B-2. (Continued)

A	B	C	D	E	F	G	H	I	J	K	L	M
SLAGEN	NORWAY	BB	60	15	25	PIE	41	49	AD DAKKAM	84	42	440 MOB SPT
MCQUIN	BAHAMAS	BB	55	16	26	LONG BEACH	53	60	AL JUBAYL	96	38	1ST MIF
						NEWS	120	134	AD DAKKAM	170	8	CSS
REGAL CRUISER	CYPRUS	BB	45	15	29	OAKLAND	40	44	AD DAKKAM	80	27	1ST SPT HNE
ANNA L	OTEE	BB	60	15	29	OAKLAND	44	63	AD DAKKAM	90	20	AMMO 1ST MIF
						SAVANNAH	134	138	AD DAKKAM	184	57	CSS
ENCOURAGEMENT	PANAMA	BB	60	16	29	LONG BEACH	51	61	AD DAKKAM	93	44	1ST CC
						MEXICO CITY	124	127	AL JUBAYL	153	36	1ST MIF
						MEIP	178		AD DAKKAM			AMMO
GALLANT II	PANAMA	BB	60	15	29	OAKLAND	41	44	AD DAKKAM	77	37	1ST CC
						MISSION	110	126	AL DAKKAM	157	47	1ST INF
						MISSION	182	192	AD DAKKAM		40	AMMO
PHEASANT	CYPRUS	BB	55	14	30	SUNNY POINT	34	44	AD DAKKAM	76	30	4TH MIF B
						WATERS	139	144	AD DAKKAM	177	58	CSS
AURORA 7	PANAMA	BB	50	13	30	SUNNY POINT	31	41	AD DAKKAM	73	50	4TH MIF B
						JAX	132	137	AD DAKKAM	175	32	CSS
MOONSTEEN 4	NORWAY	BB	55	14	31	BEAUMONT	35	39	AD DAKKAM	68	44	1ST BTR 2ND AD
						MISSION	150	160	AD DAKKAM	184	30	SUST AMMO
PACI	PANAMA	BB	60	14	31	JAX	38	46	AD DAKKAM	76	32	1ST CC
AV/ARITA	BAHAMAS	BB	40	14	34	JAX	37	40	AD DAKKAM	69	42	1ST CC
AVLIS	OTEE	BB	40	14	34	JAX	37	41	AD DAKKAM	68	23	1ST CC
MERZARIO BRITANNIA	ITALY	RORO	108			ANTWERP	124	125	AD DAKKAM	144	32	2ND CC
						JAX	68	70	AD DAKKAM	96	86	1ST CC
						WATERS	130	131	AD DAKKAM	155	21	1ST MIF
						MISSION	175	177	AD DAKKAM	201	86	1ST AMMO COLP
SAUDI ABIA	SAUDI ARABIA	RORO	150	18		MISSION	39	43	AD DAKKAM	68	126	1 CAV
						JAX	92	94	AD DAKKAM	119	150	1ST CC
						ANTWERP	137	139	AD DAKKAM	158	187	1ST AMMO
AR PARRU	LIBERIA	BB	50	15	43	TACOMA	46	49	AD DAKKAM	84	41	543 CS MAIN
BRIGHT SKEB	PHILIPPINES	BB	40	15	43	LONG BEACH	44	50	AL JUBAYL	90	37	1ST MIF
ARNDI DAKERSK	DENMARK	RORO	4	16	45	OAKLAND	50	52	AD DAKKAM	84	29	1ST CC
SAINT RON AND	FRANCE	RORO	125	17	46	JAX	59	62	AD DAKKAM	85	124	1ST CC
CANADIAN FOREST	PANAMA	RORO	80	16	50	WATERS	58	59	AD DAKKAM	82	91	1ST CC
						ANTWERP	100	111	AD DAKKAM	128	90	1ST CC
						ANTWERP	147	149	AD DAKKAM	171	96	2ND CC
						MUSCAT	175	182	AD DAKKAM	185	51	
STENA SEARIDER	BAHAMAS	RORO	50	16	94	MISSION	99	106	AD DAKKAM	137	63	54TH EN BN
ADRIAN MAERSK	DENMARK	RORO	40	16	95	PALESTINE	153	155	AD DAKKAM	169	50	1ST AMMO 44 D
						MISSION	58	56	AD DAKKAM	82	28	1ST CC
SAINT JUDIF	SAUDI ARABIA	RORO	105	16	95	WATERS	121	122	AD DAKKAM	153	36	1ST INF
JOLLY RUBINO	ITALY	RORO	73	16	98	MISSION	109	111		132	26	1ST CC
						WATERS	117	122	AD DAKKAM	153	63	1ST INF
						WATERS	162	163	AD DAKKAM		63	CSS
MANAGLIA	ROMANIA	RORO	67	17	98	NOTICE DAM	136	138	AD DAKKAM	193	52	1ST AMMO 44 D

Table B-3. (Continued)

A	B	C	D	E	F	G	H	I	J	K	L	M
ARCADE FALCON	NORWAY	ROMO	47	16	100	BREMERHAVEN	105	114	AL JURAYL	136	28	2 ACRPOMCIS
BAZAS III	ROMANIA	ROMO	32	15	100	JAX	166	187	AD DANKAM	196	25	CSS
ARASTON	CYPRUS	ROMO	57	18	101	ROTTERDAM	114	117	AD DANKAM	143	32	2ND CC
OCEAN GRACE	CYPRUS	ROMO	60	17	101	ANTWERP	123	125	AD DANKAM	144	45	2ND CC
AGROS SPYRON	MALTA	ROMO	40	17	101	ANTWERP	106	114	AD DANKAM	133	43	2ND CC
ALYCIA	MALTA	ROMO	60	16	101	ROTTERDAM	119	122	AD DANKAM	141	34	3RD AIRNAVIL CORPS
UNGUERRA	NETI ANTILLES	ROMO	35	17	101	WALLS	169	162	AD DANKAM	147	60	AMMO TCAF
PHILIPPINE EXPRESS	PHILIPPINES	ROMO	85	15	101	BREMERHAVEN	118	126	AL JURAYL	156	43	1ST AIRMOB D
SHAGO EXPRESS	PHILIPPINES	ROMO	43	15	101	ANTWERP	127	137	AD DANKAM	156	15	AMMO
SINARA EXPRESS	PHILIPPINES	ROMO	43	15	101	ANTWERP	112	117	AD DANKAM	138	48	2ND CC
FALCON	ST VINCENT	ROMO	38	17	101	ROTTERDAM	113	119	AD DANKAM	143	31	2ND CC
TRIDENT ARC	U A E	ROMO	58	15	101	ANTWERP	109	117	AD DANKAM	139	34	2ND CC
FRANMA	YUGOSLAVIA	ROMO	44	18	101	WILMINGTON	118	127	AL JURAYL	153	45	11 ME+
WARRER	CYPRUS	ROMO	37	15	101	ANTWERP	114	119	AD DANKAM	144	39	2ND CC
PRINCE SHAUL	PANAMA	ROMO	41	15	102	NEWPT NEWS	132	135	AD DANKAM	166	20	CSS
TRIDENT BALTIC	U A E	ROMO	58	15	102	NEWPT NEWS	194	194	AD DANKAM	163	40	11 ME+
TRIDENT DUSK	U A E	ROMO	58	15	102	NEWPT NEWS	125	131	AL JURAYL	183	54	222
TRIDENT ENVOYER	U A E	ROMO	58	15	102	NEWPT NEWS	124	132	AL JURAYL	183	54	222
MERCHANT PRINCE	BRITAIN	ROMO	37	18	104	ROTTERDAM	118	122	AD DANKAM	152	53	GERMANETS
AMERICAN PHARMA	CYPRUS	ROMO	50	15	104	BREMERHAVEN	123	130	AD DANKAM	140	25	SUST AMMO
ATLANTIC LILLY	CYPRUS	ROMO	44	16	104	ROTTERDAM	117	163	AD DANKAM	140	37	2ND CC
COSMANI	CYPRUS	ROMO	47	15	104	NEWPT NEWS	125	129	AD DANKAM	155	82	424 TC, 1012
EDWARD JORD	GREECE	ROMO	40	15	104	WILMINGTON	121	128	AL JURAYL	159	37	11 ME+
NORTHVEEN VILJA	NORWAY	ROMO	34	15	104	ROTTERDAM	183	137	AD DANKAM	157	44	3RD AIRMOB D
JURINA	YUGOSLAVIA	ROMO	50	18	104	JAX	119	123	AD DANKAM	159	40	CSS
STENA TRADEP	BERMUDA	ROMO	45	17	105	NEWPT NEWS	128	129	AL JURAYL	154	33	11 ME+
SKETSBORG	DENMARK	ROMO	41	15	105	ROTTERDAM	131	132	AD DANKAM	161	41	1ST INF
ZEON	POLAND	ROMO	38	13	105	BREMERHAVEN	183	184	AD DANKAM	205	27	GERMANETS
DELOS	GREECE	ROMO	45	15	106	BREMERHAVEN	181	182	AD DANKAM	204	41	GERMANETS
PELLA	GREECE	ROMO	60	15	106	ANTWERP	120	124	AD DANKAM	146	39	2ND CC
VELENE	ST VINCENT	ROMO	50	13	106	ANTWERP	119	122	AD DANKAM	143	39	2ND CC
AMERICAN SHANTI	CYPRUS	ROMO	50	15	108	NEWPT NEWS	128	131	AD DANKAM	156	43	1ST AIRMOB D
SAN SEBASTIAN	CYPRUS	ROMO	60	16	108	ANTWERP	136	139	AL JURAYL	174	35	AMMO
TOVA	CYPRUS	ROMO	40	15	108	ELMSHAVEN	123	125	AD DANKAM	147	40	2ND CC
NOTTELBERG	GERMANY	ROMO	34	18	108	ELMSHAVEN	118	138	AD DANKAM	182	35	AI AMMO
ANAMET APOLLO	GREECE	ROMO	55	14	108	WALLS	124	129	AD DANKAM	140	32	VII CORPS AR
VRACOS	HUNGARY	ROMO	35	15	108	BREMERHAVEN	129	133	AD DANKAM	153	38	1ST AIRMOB D
ATALANTA Y	PANAMA	ROMO	65	15	108	ELMSHAVEN	119	124	AD DANKAM	156	38	1/2 ADA

Table B-8. (Continued)

A	B	C	D	E	F	G	H	I	J	K	L	M
LI DUCORZ	ROLAND	BB	55	15	108	REMERVAV	123	129	AD DAWAM	148	57	1ST ARMORED
ROMAN EXPRESS	VAUATU	BB	37	15	108	LONG BEACH	127	131	AD DAWAM	185	33	222 TC
ITALIAN EXPRESS	VAUATU	BB	37	15	108	OAKLAND	116	121	AD DAWAM	167	40	MEF, TC
ARTICLE	BAHAMAS	BB	45	17	114	ANTWERP	133	135	AD DAWAM		50	MEF TO SHAWA SEA
ALTEBELS	CYPRUS	BB	45	17	114	ANTWERP	133	134	AD DAWAM	154	44	3RD ARMORED
						EMTEN	180		AD DAWAM			
JADE BAY	GREECE	BB	35	17	114	ROTTTERDAM	140	145	AD DAWAM	169	35	3RD ARMORED
ELEFHERIA K	PANAMA	BB	40	15	114	ANTWERP	130	131	AD DAWAM	153	35	3RD ARMORED
LAIPUNA	PERU	BB	50	15	114	OAKLAND	121	125	AD DAWAM	156	42	740 TC
BANGAL KALLOL	BANGLADESH	BB	48	14	115	REMERVAV	135	139	AD DAWAM	164	40	1ST ARMORED
A'MAN II	CYPRUS	BB	40	17	115	ANTWERP	134	138	AD DAWAM	158	41	3RD ARMORED
MARIE H	CYPRUS	BB	31	17	115	REMERVAV	131	135	AD DAWAM	157	34	1ST ANNA 440
KATLEBERG	GERMANY	ROFO	28	14	115	REMERVAV	121	124	AD DAWAM	144	31	1ST ARMORED
CIUDAD DE MANTA	GREECE	BB	40	18	115	JAX	150	152	AD DAWAM	177	31	11 MEF
CHIKAS	GREECE	BB	45	14	115	NEWS	127	132	AD DAWAM	160	60	1032/1220
PERNER	PANAMA	ROFO	34	15	115	ROTTTERDAM	134	136	AD DAWAM	158	26	3RD ARMORED
SPRINTER	PANAMA	ROFO	34	15	115	WILMINGTON	120	122	AD DAWAM	155	27	11 MEF
ANTIPOLIS (PERIS)	ROMANIA	ROFO	32	18	115	ANTWERP	138	143	AD DAWAM	167	33	3RD ARMORED
NEPTUNE SAFONYX	SINGAPORE	BB	35	17	115	LONG BEACH	125	131	AD DAWAM	165	33	11 MEF
VEDIELEONARDI	VAUATU	BB	42	15	115	LONG BEACH	132	138	AD DAWAM	178	38	11 MEF
CAMILLA	FINLAND	ROFO	33	15	118	ROTTTERDAM	127	128	AD DAWAM	148	28	3RD ARMORED
MISTRA	NORWAY	BB	40	14	118	ROTTTERDAM	130	132	AD DAWAM	153	49	3RD ARMORED
SKARVOY	BAHAMAS	ROFO	20	15	119	REMERVAV	129	129	AD DAWAM	156	23	1ST ARMORED
CAPE MONTEREY	CYPRUS	BB	33	17	119	ANTWERP	135	136	AD DAWAM	159	41	3RD ARMORED
CAPE SYROS	CYPRUS	BB	35	14	119	ROTTTERDAM	133	135	AD DAWAM	157	32	3RD ARMORED
CAMBRIAN EXPRESS	PANAMA	BB	31	15	119	LONG BEACH	132	136	AD DAWAM	170	40	257 TC
ANTIOS	BAHAMAS	BB	24	15	120	WILMINGTON	132	135	AD DAWAM	162	34	11 MEF
SAUDI DIRIYAH	SAUDI ARABIA	ROFO	180	18	120	WILMINGTON	134	136	AD DAWAM	157	149	CSS
SKANE LINK	SWEDEN	ROFO	70	18	120	REMERVAV	138	143	AD DAWAM	167	69	1ST ARMORED
SANDEPHUSEN	GERMANY	BB	30	15	121	ROTTTERDAM	128	130	AD DAWAM	148	38	3RD ARMORED
YANNIS II	PANAMA	BB	38	15	121	WILMINGTON	127	132	AD DAWAM	180	41	11 MEF
STENA TRAILER	BERMALDA	ROFO	50	18	122	JAX	138	142	AD DAWAM	170	40	11 MEF
ENARXIS	GREECE	BB	60	17	122	ANTWERP	135	137	AD DAWAM	159	33	3RD ARMORED
						NOT IN NAM	183	196	AD DAWAM		25	ANNO
TARRWA	NORWAY	ROFO	50	18	122	REMERVAV	129	131	AD DAWAM	181	47	1ST ID
						WYOMING	191	193	AD DAWAM		47	CSS
WLODYSLANOWO	POLAND	BB	60	18	122	WILMINGTON	129	135	AD DAWAM	183		1ST ID
PANORIOS VICTORY	CYPRUS	BB	60	15	123	ANTWERP	135	136	AD DAWAM	159	42	3RD ARMORED
MC JADE	BAHAMAS	BB	40	15	125	LONG BEACH	143	151	AD DAWAM	189	59	11 MEF
WINTER SEA	NORWAY	REFER	50	21	125	SINNY POINT	138	143	AD DAWAM	164	45	ANNO
WINTER WATER	NORWAY	REFER	50	21	125	SINNY POINT	144	152	AD DAWAM	172	40	ANNO
UNSELVA	PANAMA	BB	40	15	125	LONG BEACH	136	143	AL JUBAYL	180	39	11 MEF
MADINA C	CYPRUS	BB	29	14	128	ROTTTERDAM	138	140	AD DAWAM	185	30	3RD ARMORED
ASIAN BREEZE	LIBERIA	ROFO	54	16	128	WILMINGTON	135	137	AL JUBAYL	162	93	11 MEF
EXPEDIENT	PANAMA	BB	40	13	128	NMPT NEWS	135	138	AD DAWAM	168	34	CSS

Table B-2. (Continued)

A	B	C	D	E	F	G	H	I	J	K	L	M
KAYO PERAITS	GREECE	BB	55	14	129	JAX	148	154	AD DAWHAM	185	35	CSS
AUTO CHAMP	S. KOREA	RORO	44	18	129	ANTWERP	139	143	AD DAWHAM	182	167	ROMQLS
BELLE	PANAMA	BB	50	13	132	SUNNY POINT	153	161	AD DAWHAM		45	AMMO
ATLANTIC FREIGHTER	BAHAMAS	RORO	40	16	133	WILMINGTON	137	141	AL JUBAYL	167	40	H MEF
PAGE	CYPRUS	BB	45	14	134	ROTTERDAM	140	147	AD DAWHAM	170	28	RD AFMORED
FLEMING SF	DENMARK	CONTAINER			134	NORWAY	142	146	AD DAWHAM	189		FLEETHOSP
NAXOS	GREECE	BB	45	14	134	ROTTERDAM	137	144	AD DAWHAM	166	34	RD AFMCKRED
CLIPPER MAGIC	CYPRUS	BB	31	14	135	BOYONNE	147	149	AD DAWHAM	177	41	CSS
NEPTUNE KOLITE	SINGAPORE	BB	43	14	135	PORT HENEME	148	158	AD DAWHAM	196	30	5TH MEB AFOE
KAPTAN B. ISIN	TURKEY	FO	52	15	143	BREMEN HAVEN	153	155	AD DAWHAM	183	65	ROMQLS
MAR COUPER	PANAMA	BB	65	14	146	SUNNY POINT	170	177	AD DAWHAM		45	AMMO
NEPTUNE PERIODT	SINGAPORE	BB	35	14	146	CONDO	160	171	AL JUBAYL		40	AMMO USMC
ANGEL LEADER	GREECE	BB	50	14	148	SUNNY POINT	157	169	AD DAWHAM	199	100	MAO
NAXOS PRIDE	GREECE	BB	50	15	148	JAX	169	171	AD DAWHAM	198	26	CSS
CRYSTAL STAR	BAHAMAS	REFER	30	19	150	EARLE	157	174	AD DAWHAM	198	25	AMMO USMC NAVY
AETOS	BAHAMAS	BB	50	13	153	SUNNY POINT	172	17P	AD DAWHAM		45	AMMO
ALMAS	CYPRUS	BB	60	16	154	SUNNY POINT	161	17C	AD DAWHAM		40	AMMO
DOCK EXPRESS	DUTCH	BB	30	14	156	SUNNY POINT	168	169	AD DAWHAM	198	25	MAO
AMITE	MALTA	BB	50	16	158	SUNNY POINT	171	178	AD DAWHAM		65	MAO
WESTMAN	CYPRUS	BB	40	14	158	WALES	160	173	JIDDAH	186	45	AMMO USAF
SLEETER	NORWAY	BB	40	13	164	CONDO	185		AL JUBAYL			AMMO USMC
FLAGMARS	MALTA	BB	40	13	164	CONDO	189		JIDDAH			AMMO USAF
NORTHWESTEN 6	NORWAY	BB	40	13	165	PORT HENEME	185	195	AL JUBAYL		10	NCSTU 4
PERLA I	CYPRUS	BB	40	13	169	AMSTERDAM	172	190	AD DAWHAM		40	AMMO ARMY
AGAS	MALTA	BB	50	13	169	NORTHENHAM	173	179	AD DAWHAM	204	30	SIST MUNITIONS
AMER SHAKTI	CYPRUS	BB	50	13	170	BAZEN	177	178	AD DAWHAM		35	AMMO
AVANTI	PANAMA	BB	45	13	170	WALES	175	197	AD DAWHAM		30	AMMO USAF
BETTINA DANCK				13	170	SOLIDA BAY	176	180	AL JUBAYL	195	5	AMMO
TAKUMAMA	BRITAIN	BB	80	14	172	OAKLAND	184	191	AD DAWHAM		37	36SC + BRAT EYS
HUGO OLDENDORFF	LIBERIA	BB	55	13	172	PORT HENEME	193		CLAW			NIE/ROMB FINS
HARMONY STONE	NORWAY	BB			185	SURIC	192		AD DAWHAM			AMMO USAF
HRADO MARU	JAPAN	BB	80	17		PORT HENEME	87	75	AL JUBAYL	113	80	449 MOB
KEY SPLENDOR	JAPAN	BB	60	17		ANTWERP	149	159	AD DAWHAM	182	51	MATTING
						PUSAN	68	72	AD DAWHAM	94	60	USAF MATS
	KUWAIT	BB	70	16		BOYONNE	124	136	AD DAWHAM	168	57	CSS
						NALIA	32	39	BAHRAIN	56	54	NMCB 7
						LONG BEACH	92	100	AD DAWHAM	134	77	449 MOB
						LISBON	154	171	BAHRAIN	192	43	AMMO
KUBBAR	KUWAIT	BB	38	17		ROCKFORDS	37	45	AL JUBAYL	69	35	NMCB 4
						BREMEN HAVEN	115	122	AD DAWHAM	143	46	1ST AFMORED
						SUNNY POINT	178	185	JIDDAH		70	AMMO
ALBERT MAERSK	POLAND	RORO	40	16		GLIMFESTON	70	70	AD DAWHAM	97	59	1ST COSCOM
						INDUSTION	135	136	AD DAWHAM	167	37	1ST ID
HAKUN JEDDA	S. KOREA	BB	60	14		CONDO	130	147	AL JUBAYL	182	70	USMC AMMO
SAMSUN/HONOR	S. KOREA	BB	65	16		LONG BEACH	38	42	AL JUBAYL	79	19	1ST MEF

Table B-6. (Continued)

A	B	C	D	E	F	G	H	I	J	K	L	M
						WPT NEWS	120	123	AD DAMAM		28	1229 TC
						WPTEN WA	188	190	TURKEY	202	15	MINUTIONS
HANLIN/DAMAM	S. MOREA	88	30	13		CINHA	181	185	MUSCAT		25	MAAO

GLOSSARY

BAY	Bayonne, New Jersey
BB	breakbulk
BEAU	Beaumont, Texas
D	diesel
G	gas turbine
JAX	Jacksonville, Florida
JMRIV	James River, Virginia
LA	Los Angeles, California
LASH	lighter aboard ship
LIVO	Livorno, Italy
MED	Mediterranean
NNEWS, NEWPT NEWS	Newport News, Virginia
NORF	Norfolk, Virginia
NORLEANS	New Orleans, Louisiana
NY	New York, New York
PHIL	Philadelphia, Pennsylvania
PHUE	Port Hueneme
PROV	Providence, Rhode Island
ROOS, ROOS RDS	Roosevelt Roads, Puerto Rico
RO/RO	roll-on/roll-off ships
S	steam
SANFR	San Francisco, California
T-ACS	crane ship
WESTPAC	western Pacific

APPENDIX C
THE COST OF SEALIFT

APPENDIX C

THE COST OF SEALIFT

The total cost of sealift, from the beginning of Desert Shield on 7 August 1990 through 28 February 1991, was \$1,715,192,000, as shown in table C-1. The cost includes movement of unit equipment, ammunition, sustaining dry cargo, and POL. Costs shown are the per diem costs (or actual manifest costs in the case of SMESA) of each category of shipping during the operation but they do not include the costs of maintaining the government-owned or government-leased assets prior to Desert Shield. (RRF activation costs are included; potential costs of deactivation are not.)

Table C-1. The cost of sealift

Category	Costs (thousands of dollars)	Percent of cargo
Dry Cargo		
Prepositioned		
PREPO	52,130	3.9
MPS	158,454	7.8
	<u>210,584</u>	<u>11.7</u>
FSS	85,278	11.8
Other dry cargo		
Charters		
U.S.	134,974	10.4
Foreign	313,580	28.5
RRF	519,236	24.7
SMESA	307,895	12.8
	<u>1,275,685</u>	<u>76.5</u>
Total dry cargo	1,571,547	100.0
POL		
Charters	128,487	81.1
MSC ^a	15,158	18.9
	<u>143,645</u>	<u>100.0</u>
Total POL	143,645	100.0
Grand total	1,715,192	-

a. MSC denotes U.S.-flag ships on long-term charters to MSC when Desert Shield commenced.

About half of the total dry cargo was moved by government-owned ships at about half the total cost. Chartered foreign-flag ships carried about 28 percent of the dry cargo for about 28 percent of the total cost. (SMESA is considered to have been a U.S.-flag operation although some foreign-flag feeders were used.) The seven operating FSSs carried 11.8 percent of the dry cargo at 5.4 percent of the total cost (bearing in mind that the cost of owning and maintaining these ships prior to Desert Shield is not included.)